REVISIONS

TDRR 17693 MAR 19 1965

APPROVALS

AUTHORIZED SIGNATURES	REPRESENTING	DATE
E McAuliffe	NAA-S&ID	25 Jan 65
U. G. Hoag	MIT	18 Dec 64

INTERFACE CONTROL DOCUMENT

DR BY

CHK BY

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

G&N PSA ADAPTER MODULE
(MEASUREMENTS AND COMMANDS) ACE-S/C DIMS AND DTCS
BLOCK I VEHICLES
NAA-MIT

CODE IDENT NO.	SIZE	
03953	A	MH01-01290-200

SHEET 1 OF 31

FORM M110-N-57 NEW 4-65

REVISIONS

SYM	DESCRIPTION	REQD	REP	DATE	APPROVED

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01290-200

SHEET 2

FORM M110-N-56 NEW 4-63

M - 130 - 858

REVISIONS

CONCURRENCE REQUIREMENT

1. Approvals

This ICD, with proper authorized signatures, represents a mutual agreement between the parties listed below to document the technical interface described.

a. North American Aviation, Inc. (NAA)
Space and Information Systems Division (S&ID)
Downey, California

b. Massachusetts Institute of Technology (MIT)
Department of Aeronautics and Astronautics
Instrumentation Laboratory
Cambridge 39, Massachusetts

2. Conditions

MSC/ASPO shall resolve any disagreements between parties concerned.

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01290-200

SHEET 3

M - 130 - 858

REVISIONS

CONTENTS

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01290-200

SHEET 4

M - 130 - 858

AUTHORIZED SIGNATURES	REPRESENTING	DATE
[signature]	NAA-S&ID	11/5/65
[signature]	NAA	11/5/65

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953 | IRN № 11880

SYM.	DOCUMENT NUMBER	REV.
	ICD No. MH01-01290-200	

TITLE: G&N PSA ADAPTER
(MEASUREMENTS AND COMMANDS)
ACS-S/C DTMS AND DTGS
BLOCK I VEHICLES
NAA MIT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ASSOCIATE CONTRACTOR

RELEASE DATE

COPIES TO: | DEPT.

DESCRIPTION This IRN supersedes IRN 00810 in its entirety.

1. Make the following revisions to List II:

MEASUREMENT ID	PARAMETER	WAS	REVISE TO
CG1206 B	Phase Range	-80° to -100°	-45° to -135°
CG1207 B	Phase Range	-80° to -100°	-45° to -135°
CG1209 B	Phase Range	-80° to -100°	-45° to -135°
CG1216 B	Phase Range	-80° to -100°	-45° to -135°
CG1220 B	Phase Range	-20° to +20°	-45° to +45°
CG1306 B	Phase Range	-10° to +10°	-45° to +45°
CG1206 B, CG1207 B, CG1209 B, CG1216 B, CG1220 B, CG1306 B	Accuracy	Detection of phase difference less than ±1° at nominal supply level, constant offset less than ± 5°, resolution less than ±1°.	Detection of phase difference less than ± 2.5° at nominal supply level, constant offset less than ±5°.

TDRR 24052 NOV 16 1965

REASON: Add additional information to better define G&N Interface

DR. BY: N. Derbyshire DATE: 11-5-65
DEPT/GROUP: 699-502 EXT.: 2363
SHEET 1 OF 3

FORM M 110-N-55 REV 7-65

SYMBOLS: [A] = ATTACH IRN COPIES TO DRAWINGS

INTERFACE REVISION NOTICE

2. Make the following revisions to List II:

MEASUREMENT ID	PARAMETER	WAS	REVISE TO
CG2107 V, CG2137 V, CG2167 V	a. Signal Range Full Scale	0.5 VRMS	2.5 VRMS
	b. Accuracy	5%	Delete; Add in the remarks: "Accuracy: Test Data Required"
	c. Quadrature Component Amplitude	Not Specified	Add in the remarks: "Quadrature Component Amplitude = 1 VRMS, Max."
CG2108 V, CG2138 V, CG2168 V	In Phase Component Amplitude	Not Specified	Add in the remarks: "In Phase Component Amplitude = 200 MV RMS, Max."
CG3220 V	Accuracy	5%	10%
CG3220 V	Quadrature Component Amplitude	Not Specified	Add in the remarks: "Quadrature Component Amplitude = 10 VRMS, Max."
CG3221 V	Accuracy	5%	10%
CG3221 V	In-Phase Component Amplitude	Not specified	Add in the remarks: "In Phase Component Amplitude = 10 VRMS, Max."

3.

MEAS. ID	REMARK
CG3101V	Quadrature Component Amplitude is less than 0.7 V rms
CG3111V	Quadrature Component Amplitude is less than 0.7 V rms
CG3120V	Quadrature Component Amplitude is less than 0.4 V rms
CG3130V	Quadrature Component Amplitude is less than 0.4 V rms
CG3206V	Quadrature Component Amplitude is less than 3.5 V rms
CG3209V	Quadrature Component Amplitude is less than 4 V rms
CG3226V	Quadrature Component Amplitude is less than 3.5 V rms
CG3229V	Quadrature Component Amplitude is less than 4 V rms
CG2002V	In Phase Component Amplitude = 0.6 V rms, max.
CG2022V	In Phase Component Amplitude = 0.6 V rms, max.
CG2042V	In Phase Component Amplitude = 0.6 V rms, max.

TDRR 24052 NOV 16 1965

CODE IDENT NO.	IRN NO. 11880
03953	ICD NO. MH01-01290-200
	SHEET 2 OF 3

FORM 2940-H REV 9-65

INTERFACE REVISION NOTICE

3. cont'd

MEAS. ID	REMARK
CG2135V	In Phase Component Amplitude = 0.25 V rms, max.
CG2165V	In Phase Component Amplitude = 0.25 V rms, max.
CG2204V	Quadrature Component Amplitude = 78 M V rms, max.
CG2234V	Quadrature Component Amplitude = 78 M V rms, max.
CG2264V	Quadrature Component Amplitude = 78 M V rms, max.
CG2209V	Quadrature Component Amplitude = 250 M V rms, max.
CG2239V	Quadrature Component Amplitude = 250 M V rms, max.
CG2241V	Quadrature Component Amplitude = 250 M V rms, max.
CG2269V	Quadrature Component Amplitude = 250 M V rms, max.
CG2271V	Quadrature Component Amplitude = 250 M V rms, max.

TDRR 24052 NOV 16 1965

CODE IDENT NO.	IRN NO. 11880
03953	ICD NO. MH01-01290-200
	SHEET 3 OF 3

FORM 2940-H REV 9-65

TDRR 28861 MAY 17 1966

AUTHORIZED SIGNATURES	REPRESENTING	DATE
W. K. Mehl	NAA-S&ID	5/10/66
W. G. Gillespie	MIT	5 May 66

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953

IRN NO.: Rev 3654

ICD NO.: MH 01-01290-200 "NC"

TITLE: C&N PSA Adapter (Measurement & Commands) ACE -S/C DTMS and DTCS Block I Vehicles

NAA-MIT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ADDRESSEE

DESCRIPTION

1) Revise List I and III of MH 01-01290-200 as follows:

Parameter-Measurement I.D. Was	Is	Was	Is
CG 2001 B	CG 2001 V	CG 2264 B	CG 2264 V
CG 2002 B	CG 2002 V	CG 2269 B	CG 2269 V
CG 2021 B	CC 2021 V	CG 2271 B	CG 2271 V
CG 2022 B	CG 2022 V	CG 3101 B	CG 3101 V
CG 2041 B	CG 2041 V	CG 3103 B	CG 3103 V
CG 2042 B	CG 2042 V	CG 3111 B	CG 3111 V
CG 2107 B	CG 2107 V	CG 3120 B	CG 3120 V
CG 2108 B	CG 2108 V	CG 3130 B	CG 3130 V
CG 2135 B	CG 2135 V	CG 3201 B	CG 3201 V
CG 2137 B	CG 2137 V	CG 3206 B	CG 3206 V
CG 2138 B	CG 2138 V	CG 3221 B	CG 3221 V
CG 2165 B	CG 2165 V	CG 3226 B	CG 3226 V
CG 2167 B	CG 2167 V		
CG 2168 B	CG 2168 V		
CG 2204 B	CG 2204 V		
CG 2209 B	CG 2209 V		
CG 2234 B	CG 2234 V		
CG 2239 B	CG 2239 V		
CG 2241 B	CG 2241 V		

E.O. 48326

45178

REASON: Update ICD to agree with the Apollo Block I Baseline Master Measurement List

DRN: R9 Block

AUTHORIZED SIGNATURES	REPRESENTING	DATE
[signature]	NAA-S&ID	11/5/65
[signature]	[illegible]	[illegible]

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953 | IRN № 11876

SYM.	DOCUMENT NUMBER	REV.
	MH01-01290-200	

TITLE: G&N PSA ADAPTER (MEASUREMENTS AND COMMANDS) ACE-S/C DTMS AND DTCS BLOCK I VEHICLES NAA-MIT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ASSOCIATE CONTRACTOR

RELEASE DATE

COPIES TO: | DEPT.

DESCRIPTION

THIS IRN SUPERSEDES IRN 00811 IN ITS ENTIRETY:

REVISE LIST III, MEASUREMENT EFFECTIVITY, AS FOLLOWS:

1. Delete S/C 006 measurement effectivity for all measurements.
2. Delete S/C 015 measurement effectivity for all measurements.
3. Delete S/C 008 effectivity for the following measurements:

   CG2001B, CG2021B, CG2041B, CG3101B.

4. Add S/C 008 effectivity for the following measurements:

   CG2205V, CG2207V, CG2235V, CG2237V, CG2265V, CG2267V, CG3113V, CG3229V, CG3209V.

5. Add S/C 011 effectivity for the following measurements:

   CG3102V, CG3112V, CG3113V, CG3200V, CG3209V, CG3220V, CG3229V.

6. Delete S/C 011 effectivity for the following measurements: CG1010V, CG1301V.

REASON: UPDATE ICD TO AGREE WITH THE APOLLO BLOCK I BASELINE MASTER MEASUREMENT LIST.

TDRK 24052 NOV 16 1965

DR. BY K.Derbyshire DATE

DEPT/GROUP 699-502 EXT. 2363

SHEET 1 OF 2

FORM M 110-N-55 REV 9-65

SYMBOLS: [A] = ATTACH IRN COPIES TO DRAWINGS

7. Add B/F 14 measurement effectivity. Make identical to S/C 011 except for the following differences:

S/C 011 ONLY	B/F 14 ONLY
CG3102V, CG3112V, CG3113V, CG3200V, CG3209V, CG3220V, CG3229V	CG1010V, CG1301V

8. Add S/C 012 effectivity for measurement CG3113V.
9. Delete S/C 012 effectivity for measurement CG3220V.
10. Add S/C 017 and S/C 020 measurement effectivity. Make identical to S/C 014.
11. Add S/C 014, S/C 017 and S/C 020 effectivity for the following measurements:

    CG3101V, CG3124V, CG3134V, CG3401V, CG3404V, CG3405V, CG3410V.

TDRK 24052 NOV 16 1965.

CODE IDENT NO. 03953	IRN NO. 11876
	ICD NO. MH01-01290-200
	SHEET 2 OF 2

FORM 2940-H REV 9-65

AUTHORIZED SIGNATURES	REPRESENTING	DATE
[signature]	NAA-S&ID	11/5/65
[signature]	[signature]	[illegible]

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953

IRN № 11877

SYM.	DOCUMENT NUMBER	REV.
	ICD No. MH01-01290-200	

TITLE: G&N FSA ADAPTER MODULE (MEASUREMENTS AND COMMANDS) ACE-S/C DTMS AND DTCS BLOCK I VEHICLES NAA - MIT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ASSOCIATE CONTRACTOR

RELEASE DATE

COPIES TO: | DEPT.

DESCRIPTION

1. Add the following changes in access points to List I for series "100" optics and show the access effectivity:

MEAS. ID	Effective for B/P 014, S/C 008, 011, 012 Conn.	Hi	Lo	Effective for S/C 014, 017, 020 Conn.	Hi	Lo
CG3101V	J204	17	1	J204	17	24
CG3103V	J204	2	1	J203	20	21
CG3111V	J204	18	1	J204	18	19
CG3206V	J203	17	24	J204	10	11
CG3226V	J203	18	1	J204	2	1
CG3120V	J204	9	1	J204	9	23
CG3130V	J204	10	1	Deleted		
CG3209V	J203	9	23	Deleted		
CG3229V	J203	10	11	Deleted		

2. Add the following change to List I to show the access difference between the prototype FSA Adapter Modules and the production FSA Adapter Modules:

REASON:

Update ICD to agree with G&N mechanization.

TDRR 24052

NOV 16 1965

DR. BY K.Derbyshire DATE 11-4-65
DEPT/GROUP 699-502 EXT. 2363
SHEET 1 OF 2

FORM M 110-N-55 REV 9-65

SYMBOLS: [A] = ATTACH IRN COPIES TO DRAWINGS

INTERFACE REVISION NOTICE

2. cont'd

MEAS. ID	Effective for B/P 014, S/C 011 Conn.	Hi	Lo	Effective for S/C 008, 012, 014, 017, 020 Conn.	Hi	Lo
CG1532X	J205	18	3	J205	33	3

3. Add the following note to List I: "The following Signal return pins are tied together on connectors J203 and J204, (trays 8 and 9), effective for B/P 14, S/C 008, 011, 012: 1, 11, 12, 19, 23, 24."

TDRR 24052 NOV 16 1965

CODE IDENT NO. 03953

IRN NO. 11877
ICD NO. MH01-01290-200
SHEET 2 OF 2

FORM 2940-H REV 9-65

AUTHORIZED SIGNATURES	REPRESENTING	DATE
[illegible]	NAA-S&ID	11/5/65
[illegible]	[illegible]	[illegible]

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953 | IRN № 11878

SYM.	DOCUMENT NUMBER	REV.
	MH01-01290-200	

TITLE: G&N FSA ADAPTER MODULE (MEASUREMENTS AND COMMAND) ACE-S/C DTMS AND DTCS BLOCK I VEHICLES NAA - MIT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ASSOCIATE CONTRACTOR

RELEASE DATE

COPIES TO:	DEPT.

DESCRIPTION

This IRN supersedes IRN 00812 in its entirety.

TDRK 24052 NOV 16 1965

Make the following revision to List II.

MEAS. ID	SIGNAL RANGE IS	SIGNAL RANGE WAS	IMPEDANCE IS	IMPEDANCE WAS	*REMARKS IS	*REMARKS WAS
CG1202V	0 6VRMS	0 35VRMS	50	10K	V Max = 8VRMS Nom Amp = 5 VRMS	V MAX.= 40 VRMS Nom Amp = 28 VRMS
CG1203V	0 6VRMS	0 35VRMS	50	10K	V Max = 8VRMS	V Max = 40 VRMS
CG1204V	0 6VRMS	0 35VRMS	50	10K	V Max = 8VRMS	V Max = 40 VRMS
CG1206B	0 5VRMS	0 35VRMS	50	10K	V Max = 8VRMS	V Max = 40 VRMS
CG1207B	0 5VRMS	0 35VRMS	50	10K	V Max = 8VRMS	V Max = 40 VRMS
CG1209B	0 5VRMS	0 35VRMS	50	10K	V Max = 8VRMS	V Max = 40 VRMS
CG1212V	0 6VRMS	0 35VRMS	50	10K	V Max = 8VRMS	V Max = 40 VRMS
CG1216B	0 5VRMS	0 35VRMS	50	10K	V Max = 8VRMS	V Max = 40 VRMS
CG1220B	0 5VRMS	0 6VRMS	50	600		
CG1201V			50	600		
CG1211V			50	600		
CG1400V			50	510	Nom Amp = 2.5VRMS	Nom Amp = 2.1 to 2.9VRMS
CG1401V			50	510		
CG1402B			50	510		

REASON: *ONLY CHANGE PARAMETERS INDICATED

UPDATE ICD TO REFLECT NEW SYSTEM REQUIREMENTS

DR. BY	DATE
K.Derbyshire	
DEPT/GROUP	EXT.
699-502	2363
SHEET 1 OF 2	

FORM M 110-N-55 REV 9-65

SYMBOLS: [A] = ATTACH IRN COPIES TO DRAWINGS

INTERFACE REVISION NOTICE

REVISE LIST II AS FOLLOWS:

1. Change the source impedance value of the following measurements from 250 ohms to 50 ohms:

   CG1301V, CG1306B, CG2000V, CG2001V, CG2002V, CG2020V, CG2021V, CG2022V, CG2040V, CG2041V, CG2042V, CG2107V, CG2108V, CG2135V, CG2137V, CG2138V, CG2165V, CG2167V, CG2168V

2. Change the source impedance value of the following measurements from 10K ohms to 50 ohms:

   CG2207V, CG2237V, CG2267V, CG2205V, CG2235V, CG2265V, CG2204V, CG2234V, CG2264V.

3. Change the source impedance value of the following signals from 2K ohms to 200 ohms:

   CG4007V, CG4008V

4. Change the following remark for measurements CG2138V and CG2168V: WAS Max V = 5VRMS IS Max V = 20VRMS

5. Change the source impedance value of the following signals from 25K to 50 ohms:

   CG2209V, CG2239V, CG2241V, CG2269V, CG2271V.

6. Change the source impedance value of the following signals from 2K to 16K ohms:

   CG1020V, CG1021V, CG1030V, CG1031V.

For measurement ID's CG1500V, CG1501V, CG1510V, CG1511V, CG1520V, CG1521V, CG1530V, and CG1531V change as follows:

EFFECTIVITY	IMP IS	IMP WAS
B/P 14, S/C 011, S/C 008 and S/C 012	10K	10K
S/C 014, S/C 017 and S/C 020	20K	10K

TDRK 24052 NOV 16 1965

CODE IDENT NO.	IRN NO.	11878
03953	ICD NO.	MH01-01290-200
	SHEET	2 OF 2

FORM 2940-H REV 9-65

AUTHORIZED SIGNATURES	REPRESENTING	DATE
[signature]	NAA-S&ID	11/5/65
[signature]	MIT	11/5/65

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953 | IRN № 11879

SYM.	DOCUMENT NUMBER	REV.
	MH01-01290-200	

TITLE: GSN PSA ADAPTER MODULE (MEASUREMENTS AND COMMAND) ACE-S/C DTMS AND DTCS BLOCK I VEHICLES NAA-MIT.

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ASSOCIATE CONTRACTOR

RELEASE DATE

COPIES TO: | DEPT.

DESCRIPTION

1. ADD THE FOLLOWING CHANGES IN ACCESS POINTS TO LIST I:

MEAS ID	SIGNAL CONN/PIN	RETURN CONN/PIN
CG3102W	J204-2	J204-1
CG3112W	J203-27	J203-26
CG3113W	J203-27	J203-26
CG3200W	J203-2	J203-1
CG3124W	J203-18	J203-19
CG3134W	J203-3	J203-12
CG3401W	J203-8	J203-15
CG3404W	J203-6	J203-13
CG3405W	J203-7	J203-14
CG3410W	J205-26	J205-27

TDRR 24052 NOV 16 1965

REASON:

INCORPORATE NEW OPTICS MEASUREMENTS

DR. BY K.Denkyshire | DATE

DEPT/GROUP 699-502 | EXT. 2363

SHEET 1 OF 1

FORM M 110-N-55 REV 9-65

SYMBOLS: [A] = ATTACH IRN COPIES TO DRAWINGS

AUTHORIZED SIGNATURES	REPRESENTING	DATE
W Swedish	NAA-S&ID	11/5/65
R Gilleland	NAA-S&ID	11/5/65

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953 | IRN № 11881

SYM. | DOCUMENT NUMBER | REV.

ICD No. MH01-01290-200

TITLE: G&N PSA ADAPTER MODULE (MEASUREMENTS AND COMMANDS) ACE-S/C DTMS AND DTCS BLOCK I VEHICLES NAA - MIT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ASSOCIATE CONTRACTOR

RELEASE DATE

COPIES TO: | DEPT.

DESCRIPTION

Make the following additions to List II:

MEAS. ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	IMP	SIG. COND	S/S	REMARKS
CG3102V	SXT TRUN MTR DRIVE IN PHASE	0	10	VRMS	*	2.5K	PSD51	10	V Max = 10 VRMS 800 CPS Sine Wave In Phase Measurement PH. Range = 0 to 180 Deg. Phase Ref = CG1211V *ACC = 5% with Quad Component less than 3.5 VRMS. ACC = 10% with Quad. Component Greater than 3.5 VRMS and less than 10 VRMS
CG3112V	SXT SHT MTR. DRIVE IN PHASE	0	10	VRMS	*	2.5K	PSD51	10	V Max = 10 VRMS 800 CPS Sine Wave In Phase Measurement PH Range = 0 to 180 Deg.

REASON: Incorporate New Optics Measurements.

DR. BY K.Derbyshire | DATE 11-4-65

DEPT/GROUP 699-502 | EXT. 2363

SHEET 1 OF 3

FORM M 110-N-55 REV 9 65

SYMBOLS: [A] = ATTACH IRN COPIES TO DRAWINGS

INTERFACE REVISION NOTICE

MEAS. ID.	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	IMP	SIG. COND.	S/S	REMARKS
CG3112V (cont'd									Phase Ref = CG1211V *ACC - See remarks for CG3102V.
CG3113V	SXT SHT MTR DRIVE QUAD	0	10	VRMS	*	2.5K	PSD53	**	V Max = 10 VRMS 800 CPS Sine Wave Quad Phase Measurement Phase Range = 90 to + 90 Deg. Phase Ref = CG1211V *ACC = 5% with In Phase Component less than 3.5 VRMS ACC = 10% with In Phase Component Greater than 3.5 VRMS and less than 10 VRMS. **1 S/S S/C 011; 10 S/S S/C 008 and S/C 012
CG3200V	TRUN CDU MTR DRIVE IN PHASE	0	10	VRMS	*	2.5K	PSD51	10	V Max = 10 VRMS 800 CPS Sine Wave In Phase Measurement Phase Range = 0 to 180 Deg. Phase Ref = CG1211V *ACC - See remarks for CG3102V.
CG3124V	SCT. SHT TACH FEEDBACK IN PHASE	0	10	VRMS	*	2K	PSD51	10	V Max - 10 VRMS 800 CPS Sine Wave In Phase Measurement Phase Range = 0 to 180 Deg. Phase Ref = CG1211V *ACC - See remarks for CG3102V.
CG3134V	SCT TRUN TACH FEEDBACK IN PHASE	0	10	VRMS	*	2K	PSD51	10	V Max = 10 VRMS 800 CPS Sine Wave In Phase Measurement Phase Range = 0 to 180 Deg. Phase Ref = CG1211V *ACC - See remarks for CG3102V.

TDRR 24052 NOV 16 1965

CODE IDENT NO. 03953 | IRN NO. 11881 | ICD NO. MH01-01290-200 | SHEET 2 OF 3

FORM 2940-H REV 9 65

INTERFACE REVISION NOTICE

MEAS. ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	IMP	SIG. COND.	S/S	REMARKS
CG3401V	STAR TRACKER PRE AMP OUTPUT	0	1	VRMS	5	2K	ACD4.0	10	V Max = 1 VRMS 400 CPS Square Wave
CG3404V	X CHANNEL FORK DRIVE AMP	0	5	VRMS	5	2K	ACD4.0	10	V Max = 5 VRMS 455 CPS Sine Wave
CG3405V	Y CHANNEL FORK DRIVE AMP	0	5	VRMS	5	2K	ACD4.0	10	V Max = 5 VRMS 356 CPS Sine Wave
CG3410V	PHOTOMETER PREAMP OUTPUT	0	1	VRMS	5	2K	ACD4.0	10	V Max = 1 VRMS 550 CPS Sine Wave

2. Make the following revisions to List II:

   For Measurement ID CG3103V and CG3201V, change as follows:

ACC	
Was	Is
5	*

   Add to Remarks:

   *ACC = 5% with In Phase Component less than 3.5 VRMS. ACC = 10% with In Phase Component greater than 3.5 VRMS and less than 10 VRMS.

3. Make the following revisions to List II. This change is effective on S/C 008, 011 and 012.

   For the Measurement ID listed change S/S is 1 and 400 was 1 CG2201V, CG2231V and CG2261V.

TDRR 24052 NOV 16 1965

CODE IDENT NO. 03953 | IRN NO. 11881 | ICD NO. MH01-01290-200 | SHEET 3 OF 3

FORM 2940-H REV 9 65

AUTHORIZED SIGNATURES	REPRESENTING	DATE
W.W. Dubb	NAA-S&ID	11/5/65
[illegible]	MIT	-1

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953	IRN № 11882	
SYM.	DOCUMENT NUMBER	REV.
	MH01-01290-200	

TITLE:
GAM PSA ADAPTER MODULE (MEASUREMENTS AND COMMANDS) ACE-S/C DTMS AND DTCS BLOCK I VEHICLES NAA-MIT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ASSOCIATE CONTRACTOR

RELEASE DATE

COPIES TO: | DEPT.

DESCRIPTION

PAGE 6 PARAGRAPH 3.1

IS

THE WIRE LENGTHS FROM THE ADAPTER MODULE TO THE SIGNAL CONDITIONING UNITS WILL BE 35 FEET MAXIMUM.

WAS

THE WIRE LENGTHS FROM THE ADAPTER MODULE TO THE SIGNAL CONDITIONING UNITS WILL BE 21 FEET MAXIMUM.

REASON: MOVED "CARRY-ON" EQUIPMENT OUT OF C/M.

TDRR 24052 NOV 16 1965

DR. BY K. Derbyshire DATE

DEPT/GROUP 699-502 EXT. 2363

SHEET 1 OF 1

FORM M 110-N-55 REV 9-65

SYMBOLS: [A] = ATTACH IRN COPIES TO DRAWINGS

TDRR 28861 MAY 17 1966

AUTHORIZED SIGNATURES	REPRESENTING	DATE
M. R. White	NAA-S&ID	5/26/66
D. G. Hoag	MIT	10N-65

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953	IRN NO.: 0012 Sheet 1 of 2
ICD NO.: MH 01-01290-200 "NC"	
TITLE: G&N PSA Adapter Module (Measurements & Commands) ACE-S/C DTMS and DTCS Block I Vehicles NAA-MIT	

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ADDRESSEE

DESCRIPTION 1) Revise List II of MH 01-01290-200 as follows:

Measurement ID	Parameter	Was	Is
CG 2204 V	Signal Range High	0.2 VRMS	5.0 VRMS
CG 2207 V		0.5 VRMS	5.0 VRMS
CG 2234 V		0.2 VRMS	5.0 VRMS
CG 2237 V		0.5 VRMS	5.0 VRMS
CG 2264 V		0.2 VRMS	5.0 VRMS
CG 2267 V	Signal Range High	0.5 VRMS	5.0 VRMS

E.O. 433263

REASON: Update ICD to reflect new system requirements. DRN: R J Black

FORM 3010 R-66 REV 4-66

TDRR 28861 MAY 17 1966

AUTHORIZED SIGNATURES	REPRESENTING	DATE
	NAA-S&ID	

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953	IRN NO.: 0012 Sheet 2 of 2
ICD NO.: MH 01-01290-200 NC	
TITLE: G&N PSA Adapter Module (Measurements & commands) ACE-S/C DTMS and DTCS Block I Vehicles. NAA-MIT	

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ADDRESSEE

DESCRIPTION 2) Revise List II of MH 01-01290-200 as follows:

Measurement ID	Parameter	Was	Is
CG 1000 V	Impedance	28K	26.8K
CG 1001 V			
CG 1010 V	Impedance	28K	27.0K
CG 1011 V			

REASON: Update ICD to agree with G&N mechanization (Z out of PIPA & IRIG +120V voltages) DRN: R J Black

AUTHORIZED SIGNATURES	REPRESENTING	DATE
	NAA-S&ID	

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953 | IRN NO.: 00810 SHT 3 of 3

ICD NO.: MH01-01290-200

TITLE: G&N PSA ADAPTER MODULE (MEASUREMENTS AND COMMANDS) ACE-S/C DTMS AND DTCS BLOCK I VEHICLES NAA-MIT

DESCRIPTION Add the following information to the remarks column of List II:

MEAS. ID	REMARK
CG3101V	Quadrature Component Amplitude is less than 0.7 V rms
CG3103V	In Phase Component Amplitude is less than 3.5 V rms
CG3111V	Quadrature Component Amplitude is less than 0.7 V rms
CG3120V	Quadrature Component Amplitude is less than 0.4 V rms
CG3130V	Quadrature Component Amplitude is less than 0.4 V rms
CG3201V	In Phase Component Amplitude is less than 3.5 V rms
CG3206V	Quadrature Component Amplitude is less than 3.5 V rms
CG3209V	Quadrature Component Amplitude is less than 4 V rms
CG3226V	Quadrature Component Amplitude is less than 3.5 V rms
CG3229V	Quadrature Component Amplitude is less than 4 V rms
CG2002V	In Phase Component Amplitude = 0.6 V rms, max.
CG2022V	In Phase Component Amplitude = 0.6 V rms, max.
CG2042V	In Phase Component Amplitude = 0.6 V rms, max
CG2135V	In Phase Component Amplitude = 0.25 V rms, max
CG2165V	In Phase Component Amplitude = 0.25 V rms, max
CG2204V	Quadrature Component Amplitude = 78 M V rms, max
CG2234V	Quadrature Component Amplitude = 78 M V rms, max
CG2264V	Quadrature Component Amplitude = 78 M V rms, max
CG2209V	Quadrature Component Amplitude = 250 M V rms, max
CG2239V	Quadrature Component Amplitude = 250 M V rms, max
CG2241V	Quadrature Component Amplitude = 250 M V rms, max
CG2269V	Quadrature Component Amplitude = 250 M V rms, max
CG2271V	Quadrature Component Amplitude = 250 M V rms, max

REASON: Add additional information to better define G&N Interface

DRN: #5

TDRR 22744 SEP 28 1965

FORM MIIO-N-65 NEW 4-65

AUTHORIZED SIGNATURES	REPRESENTING	DATE
	NAA-S&ID	

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953 | IRN NO.: 00810 SHT 2 of 3

ICD NO.: MH01-01290-200

TITLE: G&N PSA ADAPTER (MEASUREMENTS AND COMMANDS) ACE-S/C DTMS AND DTCS BLOCK I VEHICLES NAA MIT

DESCRIPTION Make the following revisions to List II:

MEASUREMENT ID	PARAMETER	WAS	REVISE TO
CG2107 V, CG2137 V, CG2167 V	a. Signal Range Full Scale	0.5 VRMS	1 VRMS
	b. Accuracy	5%	Delete; Add in the remarks: "Accuracy: Test Data Required"
	c. Quadrature Component Amplitude	Not Specified	Add in the remarks: "Quadrature Component Amplitude = 1 VRMS, Max."
CG2108 V, CG2138 V, CG2168 V	d. In Phase Component Amplitude	Not Specified	Add in the remarks: "In Phase Component Amplitude = 200 MV RMS, Max."
CG3220 V	Accuracy	5%	10%
CG3220 V	Quadrature Component Amplitude	Not Specified	Add in the remarks: "Quadrature Component Amplitude = 10 VRMS, max."
CG3221 V	Accuracy	5%	10%
CG3221 V	In-Phase Component Amplitude	Not Specified	Add in the remarks: " In Phase Component Amplitude = 10 VRMS, Max."

REASON: Update ICD to Equipment Performance

DRN: #5

TDRR 22744 SEP 28 1965

AUTHORIZED SIGNATURES	REPRESENTING	DATE
W J Schaefer	NAA-S&ID	9/26/65
R G Hoaglo	MIT/IL	14 Sept 65

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953 | IRN NO.: 00810 SHT 1 of 3

ICD NO.: MH01-01290-200

TITLE: G&N PSA ADAPTER (MEASUREMENTS AND COMMANDS) ACE-S/C DTMS and DTCS BLOCK I VEHICLES NAA MIT

DESCRIPTION Make the following revisions to List II:

MEASUREMENT ID	PARAMETER	WAS	REVISE TO
CG1206 B	Phase Range	-80° to -100°	-45° to -135°
CG1207 B	Phase Range	-80° to -100°	-45° to -135°
CG1209 B	Phase Range	-80° to -100°	-45° to -135°
CG1216 B	Phase Range	-80° to -100°	-45° to -135°
CG1220 B	Phase Range	-20° to +20°	-45° to +45°
CG1306 B	Phase Range	-10° to +10°	-45° to +45°
CG1206 B, CG1207 B, CG1209 B, CG1216 B, CG1220 B, CG1306 B	Accuracy	Detection of phase difference less than ±1° at nominal supply level, constant offset less than ±5°, resolution less than ±1°	Detection of phase difference less than ±2.5° at nominal supply level, constant offset less than ±5°.

REASON: Update ICD to Equipment Performance

DRN: #5

TDRR 22744 SEP 28 1965

FORM MIIO-N-65 NEW 4-65

AUTHORIZED SIGNATURES	REPRESENTING	DATE
	NAA-S&ID	

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953 | IRN NO.: 00811 SHT 2 of 2

ICD NO.: MH01-01290-200

TITLE: G&N PSA ADAPTER MODULE (MEASUREMENTS AND COMMANDS) ACE-S/C DTMS AND DTCS BLOCK I VEHICLES NAA - MIT

DESCRIPTION

1. Add the following changes in access points to List I for series "100" optics and show the access effectivity:

MEAS. ID.	Effective for B/P 014, S/C [illegible], 008, 011, 012 Conn.	Hi	Lo	Effective for S/C 014, 017, 020 Conn.	Hi	Lo
CG3101V	J204	17	1	J204	17	24
CG3103V	J204	2	1	J203	20	21
CG3111V	J204	18	1	J204	18	19
CG3206V	J203	17	24	J204	10	11
CG3226V	J203	18	1	J204	2	1

MEAS. ID	Effective for B/P 014, S/C [illegible], 008, 011, 012 Conn.	Hi	Lo	Effective for S/C 014, 017, 020 Conn.	Hi	Lo
CG3120V	J204	9	1	J204	9	23
CG3130V	J204	10	1	Deleted		
CG3209V	J203	9	23	Deleted		
CG3229V	J203	10	11	Deleted		

2. Add the following change to List I to show the access difference between the prototype PSA Adapter Modules and the production PSA Adapter Modules:

MEAS. ID	Effective for B/P 014, S/C [illegible], 011 Conn.	Hi	Lo	Effective for S/C 008, 012, 014, 017, 020 Conn	Hi	Lo
CG1532X	J205	18	3	J205	33	3

3. Add the following note to List I: "The following Signal return pins are tied together on connectors J203 and J204, (trays 8 and 9), effective for B/P 14, S/C [illegible], 008, 011, 012: 1, 11, 12, 19, 23, 24."

REASON: Update ICD to agree with G&. mechanization

DRN: K9

TDRR 22744

SEP 28 1965

FORM MIIO-N-55 NEW 4-65

AUTHORIZED SIGNATURES	REPRESENTING	DATE
W.W. Heb	NAA-S&ID	9/26/65
D.G. Hoag	MIT/IL	14 Sept 65

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953 | IRN NO.: 00811 SHT 1 of 2

ICD NO.: MH01-01290-200

TITLE: G&N PSA ADAPTER (MEASUREMENTS AND COMMANDS) ACE-S/C DTMS AND DTCS BLOCK I VEHICLES NAA MIT

DESCRIPTION

Revise List III, Measurement Effectivity, as follows:

1. Add B/P 014 Measurement Effectivity. Make identical to S/C 011.
2. Delete S/C 015 Effectivity for all measurements.
3. Add S/C 017 and S/C 020 Measurement Effectivity. Make identical to S/C 012.
4. Delete S/C 006 effectivity for all measurements. [illegible]surement: CG1150 V.
5. Delete S/C 006 and S/C 008 effectivity for the following measurements: CG2001 V, CG2021 V, CG2041 V, CG3101 V.
6. Add S/C 006 and 008 effectivity for the following measurements: CG2205 V, CG2207 V, CG2235 V, CG2237 V, CG2265 V, CG2267 V, CG3209 V, CG3220 V, CG3229 V

TDRR 22744

SEP 28 1965

REASON: Update ICD to agree with the Apollo Block I Baseline Master Measurement List

REASON: Update ICD to agree with the Apollo Block I Baseline Master Measurement List

DRN: K10

FORM MIIO-N-55 NEW 4-65

AUTHORIZED SIGNATURES	REPRESENTING	DATE
[illegible]	NAA-S&ID	9/26/65
[illegible]	MIT/IL	14 Sept 65

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953

IRN NO.: 00812 SHT 1 of 5

ICD NO.: MH01-01290-200

TITLE: G&N PSA ADAPTER MODULE (MEASUREMENTS AND COMMANDS) ACE-S/C DTMS AND DTCS BLOCK I VEHICLES NAA - MIT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ADDRESSEE

DESCRIPTION Make the following revisions to List II. This change is effective on S/C 008, 012, 014, 017 and 020

MEAS. ID	SIGNAL RANGE IS	SIGNAL RANGE WAS	IMPEDANCE IS	IMPEDANCE WAS	*REMARKS IS	*REMARKS WAS
CG1202V	0-6VRMS	0-35VRMS	50	10K	V Max = 8VRMS Nom Amp = 5VRMS	V Max. = 40 VRMS Nom Amp = 28VRMS
CG1203V	0-6VRMS	0-35VRMS	50	10K	V Max = 8VRMS	V Max = 40VRMS
CG1204V	0-6VRMS	0-35VRMS	50	10K	V Max = 8VRMS	V Max = 40VRMS
CG1206B	0-5VRMS	0-35VRMS	50	10K	V Max = 8VRMS	V Max = 40VRMS
CG1207B	0-5VRMS	0-35VRMS	50	10K	V Max = 8VRMS	V Max = 40VRMS
CG1209B	0-5VRMS	0-35VRMS	50	10K	V Max = 8VRMS	V Max = 40VRMS
CG1212V	0-6VRMS	0-35VRMS	50	10K	V Max = 8VRMS	V Max = 40VRMS
CG1216B	0-5VRMS	0-35VRMS	50	10K	V Max = 8VRMS	V Max = 40VRMS
CG1220B	0-5VRMS	0-6 VRMS	50	600		
CG1201V			50	600		
CG1211V			50	600		

TDRR 22744 SEP 28 1965

*Only change parameters indicated

REASON: Update ICD to reflect new system requirements

DRN: [illegible]

FORM M110-N-35 NEW 4-63

AUTHORIZED SIGNATURES	REPRESENTING	DATE
	NAA-S&ID	

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953

IRN NO.: 00812 SHT 2 of 5

ICD NO.: MH01-01290-200

TITLE: G&N PSA ADAPTER MODULE (MEASUREMENTS AND COMMANDS) ACE-S/C DTMS AND DTCS BLOCK I VEHICLES NAA - MIT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ADDRESSEE

DESCRIPTION Make the following revisions to List II. This change is effective for S/C 008,012,014,017,020.

For Measurement ID listed change IMP Is 50 Was 10K

CG2204V CG2234V CG2264V
CG2205V CG2235V CG2265V
CG2207V CG2237V CG2267V

For Measurement ID listed change IMP Is 50 Was 25K

CG2209V CG2269V
CG2239V CG2271V
CG2241V ~~CG2273~~

TDRR 22744 SEP 28 1965

REASON: Update ICD to reflect new impedance requirements

DRN: [illegible]

FORM M110-N-35 NEW 4-63

AUTHORIZED SIGNATURES	REPRESENTING	DATE
	NAA-S&ID	

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953

IRN NO.: 00812 SHT 3 of 5

ICD NO.: MH01-01290-200

TITLE: G&N PSA ADAPTER MODULE (MEASUREMENTS AND COMMANDS) ACE-S/C DTMS AND DTCS BLOCK I VEHICLES NAA-MIT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ADDRESSEE

DESCRIPTION Revise List II as follows:

1. Change the source impedance value of the following measurements from 250 ohms to 50 ohms:

   CG1301V, CG1306B, CG2000V, CG2001V, CG2002V, CG2020V, CG2021V, CG2022V, CG2040V, CG2041V, CG2042V, CG2107V, CG2108V, CG2135V, CG2137V, CG2138V, CG2165V, CG2167V, CG2168V

2. Change the source impedance value of the following measurements from 10K ohms to 50 ohms:

   CG2207V, CG2237V, CG2267V

3. Change the source impedance value of the following signals from 2K ohms to 200 ohms:

   CG4007V, CG4008V

4. Change the following remark for measurements CG2138V and CG2168V:

WAS	IS
Max V = 5VRMS	Max V = 20VRMS

TDRR 22744 SEP 28 1965

REASON: Update ICD to reflect System impedances

DRN: [illegible]

FORM M110-N-35 NEW 4-63

AUTHORIZED SIGNATURES	REPRESENTING	DATE
	NAA-S&ID	

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953

IRN NO.: 00812 SHT 4 of 5

ICD NO.: MH01-01290-200

TITLE: G&N PSA ADAPTER MODULE (MEASUREMENTS AND COMMANDS) ACE-S/C DTMS AND DTCS BLOCK I VEHICLES NAA - MIT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ADDRESSEE

DESCRIPTION Make the following revisions to List II. This change is effective for B/P 14[illegible], [illegible], [illegible], and S/C 011.

MEAS. ID	SIGNAL RANGE IS	SIGNAL RANGE WAS	IMPEDANCE IS	IMPEDANCE WAS	*REMARKS IS	*REMARKS WAS
CG1201V	0-5VRMS	0-6VRMS	50	600	28VRMS Attenuated to 3.8VRMS in S/C V Max = 6VRMS Nom Amp = 3.8VRMS	28V Attenuated to 5V in S/C V Max = 8VRMS Nom Amp = 5VRMS
CG1202V	0-5VRMS	0-35VRMS	50	10K	V Max = 6VRMS Nom Amp = 3.8VRMS	V Max = 40 VRMS Nom Amp = 28 VRMS
CG1203V	0-5VRMS	0-35VRMS	50	10K	V Max = 6VRMS	V Max = 40 VRMS
CG1204V	0-5VRMS	0-35VRMS	50	10K	V Max = 6VRMS	V Max = 40 VRMS
CG1206B	0-3.8VRMS	0-35VRMS	50	10K	V Max = 6VRMS	V Max = 40 VRMS
CG1207B	0-3.8VRMS	0-35VRMS	50	10K	V Max = 6VRMS	V Max = 40 VRMS
CG1211V	0-5VRMS	0-6VRMS	50	600	28VRMS Attenuated to 3.8 VRMS in S/C V Max = 6VRMS Nom Amp = 3.8VRMS	28V Attenuated to 5V in S/C V Max = 8VRMS Nom Amp = 5VRMS
CG1212V	0-5VRMS	0-35VRMS	50	10K	V Max = 6VRMS	V Max = 40VRMS
CG1216B	0-3.8VRMS	0-35VRMS	50	10K	V Max = 6VRMS	V Max = 40VRMS
CG1220B	0-3.8VRMS	0-6VRMS	50	600		
CG1209B	0-3.8VRMS	0-35VRMS	50	10K	V Max = 6VRMS	V Max = 40VRMS

TDRR 22744 SEP 28 1965

*Only change parameters indicated

REASON: Update ICD to reflect new system requirements

DRN: [illegible]

FORM M110-N-35 NEW 4-63

REVISIONS

1.0 SCOPE

This ICD shall describe the electrical and mechanical interface between the following:

a. ACE-S/C Digital Test Measurement System (DTMS) Signal Conditioners

(1) Model No. C14-211, Digital Signal Conditioning and Multiplexing Unit

(2) Model No. C14-213, G&N Signal Conditioning and Switching Matrix Unit

b. ACE-S/C Digital Test Command System (DTCS)— Model No. C14-200, Carry-On Command Stimuli Unit

c. ACE-S/C Carry-On Junction Box, Model No. C14-202.

d. G&N Power and Servo Assembly (PSA) Adapter Module

2.0 PURPOSE

The purpose of this ICD is to assure electrical and mechanical compatibility between (1) the ACE-S/C DTMS signal conditioners and the G&N signals to be conditioned by ACE-S/C, and (2) the ACE-S/C DTCS and the G&N relays located in the PSA adapter module which are to be addressed by the DTCS. This document shall be used to define the characteristics of each of the G&N signals requiring ACE-S/C conditioning and also to define the ACE-S/C signal conditioner to be used with each signal.

3.0 MECHANICAL INTERFACE

There are ten connectors on the front of the power and servo assembly adapter module which mate with the ACE-S/C equipment, and each connector employs 6 of its 38 pins for coding information (Table I). For connector detailed information, see NASA Specification Control Drawing 1010622-1.

For connector polarization information see Appendix C.

REVISIONS

CONNECTOR CODING

TABLE I

PSA	Connector No.	Pin Numbers 16	22	29	30	37	38
1	J196	0	0	0	0	1	1
2	J197	0	0	0	1	0	1
3	J198	0	0	0	1	1	0
4	J199	0	0	1	0	0	1
5	J200	0	0	1	0	1	0
6	J201	0	0	1	1	0	0
7	J202	0	1	0	0	0	1
8	J203	0	1	0	0	1	0
9	J204	0	1	0	1	0	0
10	J205	0	1	1	0	0	0

NOTE: 1 indicates that the pin is grounded.
0 indicates that the pin has no connection.

3.1 PSA Adapter Module and DTMS Interface

G&N measurements available at the PSA adapter module will be wired to the DTMS signal conditioning units, C14-211 and C14-213, by means of the ACE-S/C Carry-On Junction Box, C14-202.

The wire lengths from the adapter module to the signal conditioning units will be 21 feet maximum.

Connector and pin information for the G&N measurements which interface with the DTMS are recorded in List I, PSA Adapter Module Interface, G&N Measurements.

REVISIONS

List I includes the following information:

a. Measurement Identification (MEAS ID)

b. Origin Signal Connector and Pin (SIGNAL CONN/PIN). The origin signal connector and pin indicates the connector and pin on the adapter module from which the signal wire is routed.

c. Origin. The origin identifies the PSA tray from which the signal originates.

d. Origin Return Connector and Pin (RETURN CONN/PIN). The origin return connector and pin indicates the connector and pin on the adapter module from which the signal wire is routed.

3.2 PSA Adapter Module and DTCS Interface

G&N commands in the PSA adapter module will be wired to the DTCS by means of the ACE-S/C Carry-On Junction Box, C14-202. Connector and pin information for the commands are listed in Table II.

TABLE II

Command Identification	Connector	Pin
KG7009	J199	19
KG7010	J199	16
KG7011	J199	17
KG7012	J199	18
KG7013	J199	20
KG7014	J199	21
KG7015	J199	22

REVISIONS

4.0 ELECTRICAL INTERFACE

4.1 G&N Measurements/DTMS Interface

List II, entitled ACE-S/C Carry-On Response System, Electrical Requirements, Guidance and Navigation System, contains information relating to the electrical interface of the G&N system to ACE-S/C. The list contains the following information.

a. Measurement Identification (MEAS ID). The first letter (C) of the seven character measurement identification denotes the measurement location as the command module. The second letter (G) designates the guidance and navigation system as the signal origin. The letter following the numerical characters indicates the measurement classification. The following classifications are used in this ICD.

B - Phase
V - Voltage
X - Discrete event

b. Measurement Description. The measurement description is a brief, definitive title given to each measurement. Standard abbreviations (Appendix B) are used where applicable.

c. Signal Range. The signal range is defined by the maximum and minimum extremes of the source signal that are to be monitored by the ACE-S/C system. It should be noted that the measured extremes do not necessarily correspond to the maximum and minimum extremes of the source signal. For those measurements involving both a phase range and a voltage range, only the voltage range is recorded in the signal range column, while the phase range is recorded in the remarks column. The definition of the terms used in the signal range column differs, depending upon the type of signal conditioner used.

The following definitions apply to all measurements except those using phase sensitive demodulator signal conditioners.

(1) Low - source signal value that corresponds to the minimum output of the ACE-S/C signal conditioner; a comma following this value indicates two-state rather than analog mechanization

(2) High - source signal value that corresponds to the maximum output of the ACE-S/C signal conditioner

(3) Units - units of the electrical signal parameter to be measured

AUTHORIZED SIGNATURES	REPRESENTING	DATE
	NAA-S&ID	

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953

IRN NO.: 00812 Sheet 5 of 5

ICD NO.: MH01-01290-200

TITLE: G&N PSA ADAPTER MODULE
(MEASUREMENTS AND COMMANDS)
ACE-S/C DTMS AND DTCS
BLOCK I VEHICLES
NAA - MIT

DESCRIPTION Make the following revisions to List II

For Measurement ID's CG1500V, CG1501V, CG1510V, CG1511V, CG1520V, CG1521V, CG1530V, and CG 1531V change as follows:

Effectivity	Imp Is	Imp Was
B/P 14, S/C 005 and S/C 011	30K	10K
S/C 008 and S/C 012	40K	10K
S/C 014, S/C 017 and S/C 020	20K	10K

For Measurement ID's CG1020V, CG1021V, CG1030V, and CG1031V change as follows:

Effectivity	Imp Is	Imp Was
B/P 14, S/C005, and S/C011	6K	2K
S/C 008, 012, 014, 017, and 020	16K	2K

DDRR 2 2 7 4

SEP 28 1965

REASON: Update ICD to reflect new system requirements

DRN: 20

FORM MH0-N-SS NEW 4-65

For those measurements using phase sensitive demodulator signal conditioners, the following definitions apply:

(1) Low - source signal value that corresponds to a signal conditioner output of 2.5 vdc (the total signal conditioner output is 0 to 5 vdc)

(2) High - source signal value that corresponds to both the minimum and maximum output of the signal conditioner, dependent upon the source signal phase with respect to a reference as follows:

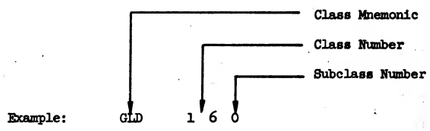
For in-phase measurements, a high-source signal value that is in phase with the reference corresponds to the maximum signal conditioner output. A high-source value that is 180 degrees out of phase with the reference corresponds to the minimum conditioner output.

For quadrature and phase difference measurements, the high-source signal value with a maximum positive (lead) phase difference between the source and the reference corresponds to the maximum signal conditioner output. A high-source signal value with a maximum negative (lag) phase difference between the source and the reference corresponds to the minimum conditioner output.

d. Accuracy (ACC) Accuracy denotes the G&N requirements for maximum error that may be introduced by the ACE-S/C system in transmitting the signal from the interface to the decommutation equipment in the control room. It is expressed as a plus or minus percentage of the signal range to which the signal conditioner is to be adjusted.

e. Impedance (IMP) The impedance is the source impedance in ohms seen by the ACE-S/C system at the interface. Protective resistors are included in the total value of the source impedance.

f. Signal Conditioner Type (SIGNAL COND). The signal conditioner type is an alphanumerical number that identifies the class and subclass of each signal conditioner.



Appendix A contains a description of each class and subclass with a brief summary of the signal conditioner characteristics.

g. Samples Per Second (S/S). Samples per second indicates the rate at which a particular measurement is sampled. The sampling rates available are 1 S/S, 10 S/S and 400 S/S. The high sampling rate, 400 S/S, is a single channel. A switching matrix in the DTMS will route one of 32 signals to this high rate channel. The control of the switching matrix will be done by the DTCS.

h. Remarks. Remarks identify additional information necessary to define the electrical requirements. This includes signal frequency, phase references, phase ranges, maximum signal amplitudes, pulse signal characteristics, modulation rates, and special signal characteristics.

4.2 G&N COMMANDS/DTCS INTERFACE.

There are seven relays located in the PSA adapter module which will be addressed from the DTCS. A command closure in the DTCS will connect the G&N command to the vehicle ground point (VGP). The seven commands are listed in Table III.

TABLE III

Command Identification	Command Description	Conditions Off	Conditions On
KG 7009	PIPA Ref. Command	Open	VGP
KG 7010	X PIPA Output Command	Open	VGP
KG 7011	Y PIPA Output Command	Open	VGP
KG 7012	Z PIPA Output Command	Open	VGP
KG 7013	IGA Step Command	Open	VGP
KG 7014	MGA Step Command	Open	VGP
KG 7015	OGA Step Command	Open	VGP

5.0 EFFECTIVITY

5.1 G&N Measurements/DTMS Implementation

Measurement effectivity information is recorded in List III. Those measurements which are marked effective for a particular vehicle indicate: (1) G&N ACE-S/C Measurement requirements as recorded in the Apollo Block I Baseline Master Measurement List, and (2) G&N Measurements being mechanized by the DTMS for that vehicle. Any official changes to the G&N ACE-S/C Measurements in the Baseline Master Measurement List will result in the revision of this ICD to reflect the change.

5.2 G&N Commands/DTCS Implementation

All seven G&N commands are required and will be mechanized by the DTCS for vehicles as follows:

Boilerplate	Spacecraft
14	006
	008
	011
	012
	014
	015
	017
	020

PSA ADAPTER MODULE INTERFACE
G/N MEASUREMENTS

MEAS ID	SIGNAL CONN/PIN	ORIGIN		RETURN CONN/PIN
CG1000V	J197-013	PSA	2	J197-020
CG1001V	J197-013	PSA	2	J197-020
CG1003V	J197-014	PSA	2	J197-020
CG1006V	J197-015	PSA	2	J197-021
CG1010V	J202-002	PSA	7	J202-001
CG1011V	J202-002	PSA	7	J202-001
CG1016V	J202-010	PSA	7	J202-009
CG1020V	J205-010	PSA	10	J205-001
CG1021V	J205-010	PSA	10	J205-001
CG1022X	J205-005	PSA	10	J205-003
CG1030V	J205-011	PSA	10	J205-001
CG1031V	J205-011	PSA	10	J205-001
CG1032X	J205-009	PSA	10	J205-003
CG1100V	J196-033	PSA	1	J196-032
CG1201V	J197-010	PSA	2	J197-001
CG1202V	J197-017	PSA	2	J197-001
CG1203V	J197-018	PSA	2	J197-001
CG1204V	J205-034	PSA	10	J205-026
CG1206B	J197-017	PSA	2	J197-001
CG1207B	J197-018	PSA	2	J197-001
CG1209B	J205-034	PSA	10	J205-026
CG1211V	J201-009	PSA	6	J201-001
CG1212V	J201-010	PSA	6	J201-001
CG1216B	J201-010	PSA	6	J201-001
CG1220B	J201-009	PSA	6	J201-001
CG1301V	J196-034	PSA	1	J196-026
CG1302V	J196-003	PSA	1	J196-004
CG1306B	J196-034	PSA	1	J196-026
CG1400V	J197-036	PSA	2	J197-035
CG1401V	J197-028	PSA	2	J197-027
CG1402B	J197-028	PSA	2	J197-027
CG1500V	J205-017	PSA	10	J205-023
CG1501V	J205-017	PSA	10	J205-023
CG1502X	J205-012	PSA	10	J205-003
CG1510V	J205-024	PSA	10	J205-023
CG1511V	J205-024	PSA	10	J205-023
CG1512X	J205-015	PSA	10	J205-003
CG1520V	J205-002	PSA	10	J205-001
CG1521V	J205-002	PSA	10	J205-001
CG1522X	J205-004	PSA	10	J205-003
CG1530V	J205-032	PSA	10	J205-031
CG1531V	J205-032	PSA	10	J205-031
CG1532X	J205-018	PSA	10	J205-003
CG2000V	J198-002	PSA	3	J198-001
CG2001B	J198-002	PSA	3	J198-001
CG2002B	J198-002	PSA	3	J198-001
CG2020V	J198-003	PSA	3	J198-001
CG2021B	J198-003	PSA	3	J198-001
CG2022B	J198-003	PSA	3	J198-001

LIST I
L-1

PSA ADAPTER MODULE INTERFACE
G/N MEASUREMENTS

MEAS ID	SIGNAL ORIGIN	SIGNAL CONN/PIN	RETURN ORIGIN	RETURN CONN/PIN
CG2040V	J159-CC2	PSA 4	J199-001	
CG2041B	J159-DD2	PSA 4	J199-001	
CG2042B	J159-CC2	PSA 4	J199-001	
CG2107B	J196-DD7	PSA 1	J196-014	
CG2108B	J196-CC7	PSA 1	J196-014	
CG2135B	J2CO-017	PSA 5	J200-001	
CG2137B	J196-CC6	PSA 1	J196-014	
CG2138B	J196-DD6	PSA 1	J196-014	
CG2165B	J2CO-009	PSA 5	J2CO-001	
CG2167B	J196-C13	PSA 1	J196-014	
CG2168B	J196-013	PSA 1	J196-014	
CG2200V	J201-C26	PSA 6	J201-034	
CG2204B	J201-020	PSA 6	J201-021	
CG2205V	J201-C20	PSA 6	J201-021	
CG2207V	J196-C20	PSA 7	J196-021	
CG2209B	J202-020	PSA 7	J202-021	
CG2214V	J2CO-020	PSA 5	J200-021	
CG2231V	J201-025	PSA 6	J201-034	
CG2234B	J201-027	PSA 6	J201-028	
CG2235V	J201-027	PSA 6	J201-028	
CG2237V	J196-027	PSA 1	J196-028	
CG2239B	J202-CC7	PSA 7	J202-008	
CG2241B	J202-035	PSA 7	J202-036	
CG2244V	J2CO-027	PSA 5	J200-028	
CG2261V	J201-C33	PSA 6	J201-034	
CG2264B	J201-035	PSA 6	J201-036	
CG2265V	J2C1-C35	PSA 6	J201-036	
CG2267V	J196-035	PSA 1	J196-036	
CG2269B	J202-014	PSA 7	J202-015	
CG2271B	J202-027	PSA 7	J202-028	
CG2274V	J2CO-035	PSA 5	J200-036	
CG2304V	J202-C18	PSA 7	J202-017	
CG3101B	J2C4-C17	PSA 9	J204-001	
CG3103B	J2C4-DD2	PSA 9	J204-001	
CG3111B	J2C4-018	PSA 9	J204-001	
CG3120B	J2C4-CC9	PSA 9	J204-001	
CG3130B	J2C4-010	PSA 9	J204-001	
CG3201B	J203-002	PSA 8	J203-001	
CG3206B	J203-017	PSA 8	J203-024	
CG3209V	J203-009	PSA 8	J203-023	
CG3220V	J203-CC3	PSA 8	J203-012	
CG3221B	J2C3-CC3	PSA 8	J203-012	
CG3226B	J203-018	PSA 8	J203-001	
CG3229V	J203-010	PSA 8	J203-011	
CG4007X	J196-C17	PSA 1	J196-026	
CG4008X	J196-018	PSA 1	J196-026	

ACE-S/C DIGITAL TEST MEASUREMENT SYSTEM

ACE-S/C CARRY-ON RESPONSE SYSTEM
ELECTRICAL REQUIREMENTS

VEHICLE-BLOCK I

SYSTEM-GUIDANCE AND NAV

15 DEC. 1964

MEAS ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	SIGNAL IMP	COND	S/S	REMARKS
CG1000V	+120 VDC IRIG SUPPLY	0 +	45	VDC	2	28K	ISA 20	1	120 VDC ATT TO 40 V IN S/C
CG1001V	+120 VDC IRIG SUPPLY NOISE RMS	0	2	VRMS	30	28K	ANC 130	1	NOISE MEAS OF CG1000V FREQ = 50 CPS TO 10 KC
CG1003V	+12 VDC IRIG SUPPLY	0 +	15	VDC	2	2K	ISA 20	1	
CG1006V	+32 VDC IRIG SUPPLY	0 +	40	VDC	2	5.1K	ISA 20	1	
CG1010V	+120 VDC PIPA SUPPLY	0 +	45	VDC	2	28K	ISA 20	1	120 VDC ATT TO 40 V IN S/C
CG1011V	+120 VDC PIPA NOISE RMS	0	2	VRMS	30	28K	ANC 130	1	NOISE MEAS OF CG1010V FREQ = 50 CPS TO 10 KC
CG1016V	+32 VDC PIPA SUPPLY	0 +	40	VDC	2	5.1K	ISA 20	1	
CG1020V	+13 VDC AGC SUPPLY	0 +	20	VDC	2	2K	ISA 20	1	
CG1021V	+13 VDC AGC SUPPLY NOISE RMS	0	.8	VRMS	20	2K	ANC 130	1	NOISE MEAS OF CG1020V FREQ = 50 CPS TO 10 KC
CG1022X	+13 VDC AGC SUPPLY NOISE PEAK	0,+	5.5	VPK	-	100	GLD 160	10	SPIKE MEAS OF CG1020V PULSE OUTPUT OF ONE SHOT ON LEVEL = +5.5 TO + 8 VDC OFF LEVEL = 0 +OR- 0.5 VDC PULSE DURATION (ABOVE 4VDC) = 20 MICRO SEC, MIN FALL TIME = 2 MICRO SEC,MAX RISE TIME = 2 MICRO SEC,MAX PULSE CHARACTERISTICS AS DEFINED INCLUDE AN ACE LOAD AS FOLLOWS R = 50K OHMS C = 0.002 MICRO FARAD
CG1030V	+3 VDC AGC SUPPLY	0 +	4	VDC	2	2K	DCA 02	1	
CG1031V	+3 VDC AGC SUPPLY NOISE RMS	0	.5	VRMS	20	2K	ANC 130	1	NOISE MEAS OF CG1030V FREQ = 50 CPS TO 10 KC

ACE-S/C DIGITAL TEST MEASUREMENT SYSTEM

ACE-S/C CARRY-ON RESPONSE SYSTEM
ELECTRICAL REQUIREMENTS

VEHICLE-BLOCK I

SYSTEM-GUIDANCE AND NAV

15 DEC. 1964

MEAS ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	SIGNAL IMP	COND	S/S	REMARKS
CG1032X	+3 VDC AGC SUPPLY NOISE PEAK	0,+	5.5	VPK	-	100	GLD 160	10	SPIKE MEAS OF CG1030V SEE REMARKS OF CG1022X FOR PULSE CHARACTERISTICS
CG1100V	-28 VDC SUPPLY	0 -	30	VDC	5	10K	ISA 22	1	
CG1201V	IMU 28V .8KC 1 PCT 0 DEG SUP RMS	0	6	VRMS	2	600	ACD 41	1	28V ATTENUATED TO 5V IN S/C V MAX = 8 VRMS 800 CPS SINE WAVE
							REC 800		PH REF SOURCE FOR C14-213-1 NOM AMP = 5 VRMS
CG1202V	IMU 28V .8KC 5 PCT-90DEG SUP RMS	0	35	VRMS	2	10K	ACD 41	1	V MAX = 40 VRMS 800 CPS SINE WAVE
							REC 800		PH REF SOURCE FOR C14-213-1 NORM PH SHIFT = -90 DEG LAG
CG1203V	IMU 28V .8KC 5 PCT 0 DEG SUP RMS	0	35	VRMS	2	10K	ACD 41	1	NOM AMP = 28 VRMS V MAX = 40 VRMS 800 CPS SINE WAVE
CG1204V	CDU 28V .8KC 5 PCT-90DEG SUP RMS	0	35	VRMS	2	10K	ACD 41	1	V MAX = 40 VRMS 800 CPS SINE WAVE NORM PH SHIFT = -90 DEG LAG

ACE-S/C DIGITAL TEST MEASUREMENT SYSTEM

ACE-S/C CARRY-ON RESPONSE SYSTEM
ELECTRICAL REQUIREMENTS

VEHICLE-BLOCK I

SYSTEM-GUIDANCE AND NAV

15 DEC. 1964

MEAS ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	SIGNAL IMP	COND	S/S	REMARKS
CG1206B	PH DIFF IMU 1-5 PCT 0--90 DEG	0	35	VRMS	*	10K	PSD 51	1	PHASE REF=CG1201V PH DIFF OF CG1202V/CG1201V CG1202V HAS A NORMAL -90 DEG LAG PHASE SHIFT PH RANGE = -80 TO -100 DEG V MAX = 40 VRMS *ACCURACY=DETECTION OF PH DIFF LESS THAN PLUS OR MINUS 1 DEG AT NOM SUPPLY LEVEL, CONSTANT OFFSET LESS THAN PLUS OR MINUS 5 DEG, RESOLUTION LESS THAN PLUS OR MINUS 1 DEG
CG1207B	PH DIFF IMU 5-5 PCT -90-0 DEG	0	35	VRMS	*	10K	PSD 51	1	PHASE REF=CG1202V PH DIFF OF CG1203V/CG1202V CG1202V HAS A NORMAL -90 DEG LAG PHASE SHIFT PH RANGE = -80 TO -100 DEG V MAX = 40 VRMS *ACC SEE REMARKS FOR CG1206
CG1209B	PH DIFF CDU 5P 90D IMU 1P 0 DEG	0	35	VRMS	*	10K	PSD 51	1	PHASE REF=CG1201V PH DIFF OF CG1204V/CG1201V CG1204V HAS A NORMAL -90 DEG LAG PHASE SHIFT PH RANGE = -80 TO -100 DEG V MAX = 40 VRMS *ACC SEE REMARKS FOR CG1206

ACE-S/C DIGITAL TEST MEASUREMENT SYSTEM

ACE-S/C CARRY-ON RESPONSE SYSTEM
ELECTRICAL REQUIREMENTS

VEHICLE-BLOCK I

SYSTEM-GUIDANCE AND NAV

15 DEC. 1964

MEAS ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	SIGNAL IMP	COND	S/S	REMARKS
CG1211V	GPTX 28V .8KC 1PCT 0 DEG SUP RMS	0	6	VRMS	2	600	ACD 41	1	28V ATTENUATED TO 5V IN S/C V MAX = 8 VRMS 800 CPS SINE WAVE
							REC 800		PH REF SOURCE FOR C14-213-1
							REC 800		PH REF SOURCE FOR C14-213-2
CG1212V	GPTX 28V .8KC 5 PCT -90D SUP RMS	0	35	VRMS	2	10K	ACD 41	1	NOM AMP = 5 VRMS V MAX = 40 VRMS 800 CPS SINE WAVE
CG1216B	PH DIFF GPTX 1-5 PCT 0--90 DEG	0	35	VRMS	•	10K	PSD 51	1	NORM PH SHIFT = -90 DEG LAG PHASE REF=CG1211V PH DIFF OF CG1212V/CG121'V CG1212V HAS A NORMAL -90 DEG LAG PHASE SHIFT PH RANGE = -80 TO -100 DEG VMAX=40 VRMS •ACC SEE REMARKS FOR CG1206
CG1220B	PH DIFF GPTX 1PCT / IMU 1PCT	0	6	VRMS	•	600	PSD 52	1	PHASE REF=CG1201V PH DIFF OF CG1211V/CG1201V PH RANGE = -20 TO +20 DEG •ACC SEE REMARKS FOR CG1206
CG1301V	IMU 2V 3200 CPS SUPPLY RMS	0	5	VRMS	2	250	ACD 40	1	NOM AMP = 3 TO 5 VRMS 3200 CPS SINE WAVE
							REC3200		PH REF SOURCE FOR C14-213-1
CG1302V	20V 3.2KC SQ WAVE SUPPLY RMS	0	25	VRMS	2	1K	REC3200 ACD 41	1	PH REF SOURCE FOR C14-213-2 3200 CPS SQUARE WAVE

MEAS ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	SIGNAL IMP	COND	S/S	REMARKS
CG1306B	PH DIFF IMU 3.2KC AGC SYNC	0	2.5	VRMS	•	250	PSD 50	1	PH DIFF OF CG1301V/CG4007,8 PHASE REF=CG4007, 8X V MAX = 5 VRMS PH RANGE =-10 TO + 10 DEG •ACC SEE REMARKS FOR CG1206
CG1400V	IMU 2V 25.6 KC SUPPLY RMS	0	3	VRMS	5	510	ACD 40	1	25,600 CPS SINE WAVE
							REC25.6		PH REF SOURCE FOR C14-213-3 NOM AMP = 2.1 TO 2.9 VRMS
CG1401V	GPTX 2V 25.6 KC SUPPLY RMS	0	3	VRMS	5	510	ACD 40	1	25,600 CPS SINE WAVE
CG1402B	IN PHASE IMU 25.6 / GPTX 25.6	0	3	VRMS	10	510	PSD 56	1	25,000 CPS SINE WAVE IN PH MEAS OF CG1400/CG1401 PH RANGE = 0 TO 180 DEG PHASE REF = CG1400V
CG1500V	+28 VDC BUS 1	0 +	30	VDC	2	10K	ISA 20	1	
CG1501V	+28 VDC BUS 1 NOISE RMS	0	2	VRMS	10	10K	ANC 130	1	NOISE MEAS OF CG1500V FREQ = 50 CPS TO 10 KC
CG1502X	+28 VDC BUS 1 NOISE PEAKS	0,+	5.5	VPK	-	100	GLD 160	10	SPIKE MEAS OF CG1500V SEE REMARKS OF CG1022X FOR PULSE CHARACTERISTICS
CG1510V	+28 VDC BUS 2	0 +	30	VDC	10	10K	ISA 20	1	
CG1511V	+28 VDC BUS 2 NOISE RMS	0	2	VRMS	10	10K	ANC 130	1	NOISE MEAS OF CG1510V FREQ = 50 CPS TO 10 KC
CG1512X	+28 VDC BUS 2 NOISE PEAKS	0,+	5.5	VPK	-	100	GLD 160	10	SPIKE MEAS OF CG1510V SEE REMARKS OF CG1022X FOR PULSE CHARACTERISTICS
CG1520V	+28 VDC BUS 3	0 +	30	VDC	2	10K	ISA 20	1	

MEAS ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	SIGNAL IMP	COND	S/S	REMARKS
CG1521V	+28 VDC BUS 3 NOISE RMS	0	2	VRMS	10	10K	ANC 130	1	NOISE MEAS OF CG1520V FREQ = 50 CPS TO 10 KC
CG1522X	+28 VDC BUS 3 NOISE PEAKS	0,+	5.5	VPK	-	100	GLD 160	10	SPIKE MEAS OF CG1520V SEE REMARKS OF CG1022X FOR PULSE CHARACTERISTICS
CG1530V	+28 VDC BUS 4	0 +	30	VDC	2	10K	ISA 20	1	
CG1531V	+28 VDC BUS 4 NOISE RMS	0	2	VRMS	10	10K	ANC 130	1	NOISE MEAS OF CG1530V FREQ = 50 CPS TO 10 KC
CG1532X	+28 VDC BUS 4 NOISE PEAKS	0,+	5.5	VPK	-	100	GLD 160	10	SPIKE MEAS OF CG1530V SEE REMARKS OF CG1022X FOR PULSE CHARACTERISTICS
CG2000V	X PIPA S G OUTPUT RMS	0	1	VRMS	10	250	ACD 40	1	3200 CPS SINE WAVE V MAX = 7 VRMS NORM PH SHIFT = -45 DEG LAG
CG2001V	X PIPA S G OUTPUT IN PHASE	0	.5	VRMS	10	250	PSD 54	400	V MAX = 7 VRMS MOD RATE = 60 CPS MAX IN PHASE MEAS OF CG2000V CG2000V HAS A NORMAL -45 DEG LAG PHASE SHIFT PH RANGE = -45 TO -225 DEG PHASE REF=CG1301V
CG2002V	X PIPA S G OUTPUT QUAD	0	.8	VRMS	10	250	PSD 55	1	V MAX = 7 VRMS QUAD PH MEAS OF CG2000V CG2000V HAS A NORMAL -45 DEG LAG PHASE SHIFT PH RANGE = -135 TO +45 DEG PHASE REF=CG1301V

MEAS ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	SIGNAL IMP	COND	S/S	REMARKS
CG2020V	Y PIPA S G OUTPUT RMS	0	1	VRMS	10	250	ACD 40	1	3200 CPS SINE WAVE V MAX = 7 VRMS NORM PH SHIFT = -45 DEG LAG
CG2021V	Y PIPA S G OUTPUT IN PHASE	0	.5	VRMS	10	250	PSD 54	400	V MAX = 7 VRMS MOD RATE = 60 CPS MAX IN PHASE MEAS OF CG2020V CG2020V HAS A NORMAL -45 DEG LAG PHASE SHIFT PH RANGE = -45 TO -225 DEG PHASE REF=CG1301V
CG2022V	Y PIPA S G OUTPUT QUAD	0	.8	VRMS	10	250	PSD 55	1	V MAX = 7 VRMS QUAD PH MEAS OF CG2020V CG2020V HAS A NORMAL -45 DEG LAG PHASE SHIFT PH RANGE = -135 TO +45 DEG PHASE REF=CG1301V
CG2040V	Z PIPA S G OUTPUT RMS	0	1	VRMS	10	250	ACD 40	1	3200 CPS SINE WAVE V MAX = 7 VRMS NORM PH SHIFT = -45 DEG LAG
CG2041V	Z PIPA S G OUTPUT IN PHASE	0	.5	VRMS	10	250	PSD 54	400	V MAX = 7 VRMS MOD RATE = 60 CPS MAX IN PH MEAS OF CG2040V CG2040V HAS A NORMAL -45 DEG LAG PHASE SHIFT PH RANGE = -45 TO -225 DEG PHASE REF=CG1301V

ACE-S/C DIGITAL TEST MEASUREMENT SYSTEM

ACE-S/C CARRY-ON RESPONSE SYSTEM
ELECTRICAL REQUIREMENTS

VEHICLE-BLOCK I

SYSTEM-GUIDANCE AND NAV

15 DEC. 1964

MEAS ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	SIGNAL IMP	SIGNAL COND	S/S	REMARKS
CG2042V	Z PIPA SG OUTPUT QUAD	0	.8	VRMS	10	250	PSD 55	1	V MAX = 7 VRMS QUAD PH MEAS OF CG2040V CG2040V HAS A NORMAL -45 DEG LAG PHASE SHIFT PH RANGE = -135 TO +45 DEG PHASE REF=CG1301V
CG2107V CG2107V	IGA SERVO ERROR IN PHASE	0	.5	VRMS	5	250	PSD 50	1 400	IN PH MEAS. V MAX =20 VRMS 3200 CPS SINE WAVE MOD RATE = 60 CPS MAX PH RANGE = 0 TO 180 DEG PHASE REF=CG1301V
CG2108V	IGA SERVO ERROR QUAD	0	3	VRMS	5	250	PSD 52	1	V MAX =20 VRMS QUAD PH MEAS OF CG2107V PH RANGE = -90 TO +90 DEG PHASE REF=CG1301V
CG2135V	Z IRIG PREAMP OUTPUT QUAD	0	3	VRMS	5	250	PSD 52	1	V MAX = 5 VRMS 3200 CPS SINE WAVE QUAD PH MEAS PH RANGE = -90 TO +90 DEG PHASE REF=CG1301V
CG2137V CG2137V	MGA SERVO ERROR IN PHASE	0	.5	VRMS	5	250	PSD 50	1 400	IN PH MEAS. V MAX = 20 VRMS 3200 CPS SINE WAVE MOD RATE = 60 CPS MAX PH RANGE = 0 TO 180 DEG PHASE REF=CG1301V

ACE-S/C DIGITAL TEST MEASUREMENT SYSTEM

ACE-S/C CARRY-ON RESPONSE SYSTEM
ELECTRICAL REQUIREMENTS

VEHICLE-BLOCK I

SYSTEM-GUIDANCE AND NAV

15 DEC. 1964

MEAS ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	SIGNAL IMP	SIGNAL COND	S/S	REMARKS
CG2138V	MGA SERVO ERROR QUAD	0	3	VRMS	5	250	PSD 52	1	V MAX = 5 VRMS QUAD PH MEAS OF CG2137V PH RANGE = -90 TO + 90 DEG PHASE REF=CG1301V
CG2165V	X IRIG PREAMP OUTPUT QUAD	0	3	VRMS	5	250	PSD 52	1	V MAX = 5 VRMS 3200 CPS SINE WAVE PH RANGE = -90 TO + 90 DEG PHASE REF=CG1301V
CG2167V CG2167V	OGA SERVO ERROR IN PHASE	0	.5	VRMS	5	250	PSD 50	1 400	IN PH MEAS V MAX = 20 VRMS 3200 CPS SINE WAVE MOD RATE = 60 CPS MAX PH RANGE = 0 TO 180 DEG PHASE REF=CG1301V
CG2168V	OGA SERVO ERROR QUAD	0	3	VRMS	5	250	PSD 52	1	V MAX = 5 VRMS QUAD PH MEAS OF CG2167V PH RANGE = -90 TO + 90 DEG PHASE REF=CG1301V
CG2201V CG2204V	IGA CDU FAIL SIGNAL RMS IGA CDU 16X RES ERROR IN PHASE	0 0	5 .2	VRMS VRMS	5 5	15K 10K	ACD 40 PSD 50	1 10	800 CPS SQUARE WAVE V MAX = 28 VRMS 800 CPS SINE WAVE IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF=CG1301V
CG2205V	IGA CDU 16X RES ERROR RMS	0	.5	VRMS	5	10K	ACD 40	1	800 CPS SINE WAVE V MAX = 28 VRMS
CG2207V	IGA CDU 1X RES ERROR RMS	0	.5	VRMS	5	10K	ACD 40	1	800 CPS SINE WAVE V MAX = 28 VRMS

ACE-S/C DIGITAL TEST MEASUREMENT SYSTEM

ACE-S/C CARRY-ON RESPONSE SYSTEM
ELECTRICAL REQUIREMENTS

VEHICLE-BLOCK I

SYSTEM-GUIDANCE AND NAV

15 DEC. 1964

MEAS ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	SIGNAL IMP	SIGNAL COND	S/S	REMARKS
CG2209V CG2209V	SCS PITCH IN PHASE	0	3	VRMS	5	25K	PSD 50	1 400	V MAX = 28 VRMS 800 CPS SINE WAVE MOD RATE = 60 CPS MAX IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF=CG1201V
CG2214V CG2214V	IG DAC ERROR SIGNAL	0	6	VRMS	5	5.1K	ACD 41	1 400	800 CPS SQUARE WAVE MOD RATE = 60 CPS MAX
CG2231V	MGA CDU FAIL SIGNAL RMS	0	5	VRMS	5	15K	ACD 40	1	800 CPS SQUARE WAVE
CG2234V	MGA CDU 16X RES ERROR IN PHASE	0	.2	VRMS	5	10K	PSD 50	10	V MAX = 28 VRMS 800 CPS SINE WAVE IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF=CG1201V
CG2235V	MGA CDU 16X RES ERROR RMS	0	.5	VRMS	5	10K	ACD 40	1	800 CPS SINE WAVE V MAX = 28 VRMS
CG2237V	MGA CDU 1X RES ERROR RMS	0	.5	VRMS	5	10K	ACD 40	1	800 CPS SINE WAVE V MAX = 28 VRMS
CG2239V CG2239V	SCS YAW BODY AXIS IN PHASE	0	3	VRMS	5	25K	PSD 50	1 400	V MAX = 28 VRMS 800 CPS SINE WAVE MOD RATE = 60 CPS MAX IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF=CG1201V

ACE-S/C DIGITAL TEST MEASUREMENT SYSTEM

ACE-S/C CARRY-ON RESPONSE SYSTEM
ELECTRICAL REQUIREMENTS

VEHICLE-BLOCK I

SYSTEM-GUIDANCE AND NAV

15 DEC. 1964

MEAS ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	SIGNAL IMP	SIGNAL COND	S/S	REMARKS
CG2241V CG2241V	SCS YAW OFFSET AXIS IN PHASE	0	3	VRMS	5	25K	PSD 50	1 400	V MAX = 28 VRMS 800 CPS SINE WAVE MOD RATE = 60 CPS MAX IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF=CG1201V
CG2244V CG2244V	MG DAC ERROR SIGNAL	0	6	VRMS	5	5.1K	ACD 41	1 400	800 CPS SQUARE WAVE MOD RATE = 60 CPS MAX
CG2261V	OG CDU FAIL SIGNAL RMS	0	5	VRMS	10	15K	ACD 40	1	800 CPS SQUARE WAVE
CG2264V	OGA CDU 16X RES ERROR IN PHASE	0	.2	VRMS	5	10K	PSD 50	10	V MAX = 28 VRMS 800 CPS SINE WAVE IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF=CG1201V
CG2265V	OGA CDU 16X RES ERROR RMS	0	.5	VRMS	5	10K	ACD 40	1	800 CPS SINE WAVE V MAX = 28 VRMS
CG2267V	OGA CDU 1X RES ERROR RMS	0	.5	VRMS	5	10K	ACD 40	1	800 CPS SINE WAVE V MAX = 28 VRMS
CG2269V CG2269V	SCS ROLL BODY AXIS IN PHASE	0	3	VRMS	5	25K	PSD 50	1 400	V MAX = 28 VRMS 800 CPS SINE WAVE MOD RATE = 60 CPS MAX IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF=CG1201V

ACE-S/C DIGITAL TEST MEASUREMENT SYSTEM

ACE-S/C CARRY-ON RESPONSE SYSTEM
ELECTRICAL REQUIREMENTS

VEHICLE-BLOCK I

SYSTEM-GUIDANCE AND NAV

15 DEC. 1964

MEAS ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	IMP	SIGNAL COND	S/S	REMARKS
CG2271V CG2271V	SCS ROLL OFFSET AXIS IN PHASE	0	3	VRMS	5	25K	PSD	50 400	1 V MAX = 28 VRMS 800 CPS SINE WAVE MOD RATE = 60 CPS MAX IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF=CG1201V
CG2274V CG2274V	OG DAC ERROR SIGNAL	0	6	VRMS	5	5.1K	ACD	41	1 8CO CPS SQUARE WAVE 400 MOD RATE = 60 CPS MAX
CG2304V	IMU TEMP CONTROL BRIDGE SUPPLY	0 +	25	VDC	5	10K	ISA	20	1
CG3101V CG3101V	TRUN CDU 16X RES ERROR IN PHASE	0	2	VRMS	5	2.5K	PSD	50 400	10 V MAX = 10 VRMS 800 CPS SINE WAVE MOD RATE = 60 CPS MAX IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF=CG1211V
CG3103V	SXT TRUN MOTOR DRIVE QUAD	0	10	VRMS	5	2.5K	PSD	53	1 V MAX = 14 VRMS 8CO CPS SINE WAVE QUAD PHASE MEASUREMENT PH RANGE = -90 TO +90 DEG PHASE REF=CG1211V
CG3111V CG3111V	SHAFT CDU 16X RES IN PHASE	0	2	VRMS	5	2.5K	PSD	50 400	10 V MAX = 10 VRMS 800 CPS SINE WAVE MOD RATE = 60 CPS MAX IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF=CG1211V

ACE-S/C DIGITAL TEST MEASUREMENT SYSTEM

ACE-S/C CARRY-ON RESPONSE SYSTEM
ELECTRICAL REQUIREMENTS

VEHICLE-BLOCK I

SYSTEM-GUIDANCE AND NAV

15 DEC. 1964

MEAS ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	IMP	SIGNAL COND	S/S	REMARKS
CG3120V CG3120V	SCT TRUN 1X RES ERROR IN PHASE	0	1.2	VRMS	5	2.5K	PSD	50 400	10 V MAX = 10 VRMS 800 CPS SINE WAVE MOD RATE = 60 CPS MAX IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF=CG1211V
CG3130V CG3130V	SCT SHAFT 1/2X RES ERROR IN PHAS E	0	1.2	VRMS	5	2.5K	PSD	50 400	10 V MAX = 10 VRMS 8CO CPS SINE WAVE MOD RATE = 60 CPS MAX IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF=CG1211V
CG3201V	TRUN CDU MOTOR DRIVE QUAD	0	10	VRMS	5	2.5K	PSD	53	1 V MAX = 14 VRMS 800 CPS SINE WAVE QUAD PHASE MEASUREMENT PH RANGE = -90 TO + 90 DEG PHASE REF=CG1211V
CG3206V CG3206V	TRUN CDU TACH OUTPUT IN PHASE	0	10	VRMS	5	2.5K	PSD	51 400	10 800 CPS SINE WAVE MOD RATE = 60 CPS MAX IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF=CG1211V
CG3209V	OPTX DIRECT TRUNION CONTLR IN PH	0	11	VRMS	5	2.5K	PSD	51	10 V MAX = 28 VRMS 800 CPS SINE WAVE IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF = CG1211V

ACE-S/C DIGITAL TEST MEASUREMENT SYSTEM

ACE-S/C CARRY-ON RESPONSE SYSTEM
ELECTRICAL REQUIREMENTS

VEHICLE-BLOCK I

SYSTEM-GUIDANCE AND NAV

15 DEC. 1964

MEAS ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	IMP	SIGNAL COND	S/S	REMARKS
CG3220V	SHAFT CDU MOTOR DRIVE IN PHASE	0	10	VRMS	5	2.5K	PSD	51	10 V MAX = 14 VRMS 8CO CPS SINE WAVE IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF = CG1211V
CG3221V	SHAFT CDU MOTOR DRIVE QUAD	0	10	VRMS	5	2.5K	PSD	53	1 V MAX = 14 VRMS 800 CPS SINE WAVE QUAD PHASE MEASUREMENT PH RANGE = -90 TO + 90 DEG PHASE REF=CG1211V
CG3226V CG3226V	SHAFT CDU TACH OUTPUT IN PHASE	0	10	VRMS	5	2.5K	PSD	51 400	10 800 CPS SINE WAVE MOD RATE = 60 CPS MAX IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF=CG1211V
CG3229V	OPTX DIRECT SHAFT CONTLR IN PH	0	11	VRMS	5	2.5K	PSD	51	1 V MAX = 28 VRMS 8CO CPS SINE WAVE IN PHASE MEASUREMENT PH RANGE = 0 TO 180 DEG PHASE REF = CG1211V

ACE-S/C DIGITAL TEST MEASUREMENT SYSTEM

ACE-S/C CARRY-ON RESPONSE SYSTEM
ELECTRICAL REQUIREMENTS

VEHICLE-BLOCK I

SYSTEM-GUIDANCE AND NAV

15 DEC. 1964

MEAS ID	MEASUREMENT DESCRIPTION	SIGNAL RANGE LOW	HIGH	UNITS	ACC	IMP	SIGNAL COND	S/S	REMARKS
CG4007V	3200 PPS SET	0	7	VDC		2K	REG3200		PH REF SOURCE FOR C14-213-2 ON= +7 VDC +/- 2 VDC OFF= -0.5 TO +2.5 VDC PW= 3 +/- 0.3 MICRO SEC RISE TIME=0.2 MICRO SEC MAX FALL TIME=0.2 MICRO SEC MAX DROOP = 20 PCT MAX BACKSWING = 4 VDC MAX NOISE = 0.2 VPK MAX
CG4008V	3200 PPS RESET	0	7	VDC		2K			RESET INPUT TO REG 3200 RESET LAGS SET BY 180 DEG SEE CG4007

G-N MEASUREMENT EFFECTIVITY FOR VEHICLES
X = EFFECTIVE, O = NOT EFFECTIVE, BLANK = UNKNOWN

MEAS ID	MEASUREMENT DESCRIPTION	SPACECRAFT 006	008	011	012	014	015	017	020
CG1000V	+120 VDC IRIG SUPPLY	X	X	X	X	X	X		
CG1001V	+120 VDC IRIG SUPPLY NOISE RMS	X	X	X	X	X	X		
CG1003V	+12 VDC IRIG SUPPLY	X	X	X	X	X	X		
CG1006V	+32 VDC IRIG SUPPLY	X	X	X	X	X	X		
CG1010V	+120 VDC PIPA SUPPLY	X	X	X	X	X	X		
CG1011V	+120 VDC PIPA NOISE RMS	X	X	X	X	X	X		
CG1016V	+32 VDC PIPA SUPPLY	X	X	X	X	X	X		
CG1020V	+13 VDC AGC SUPPLY	X	X	X	X	X	X		
CG1021V	+13 VDC AGC SUPPLY NOISE RMS	X	X	X	X	X	X		
CG1022X	+13 VDC AGC SUPPLY NOISE PEAK	X	X	X	X	X	X		
CG1030V	+3 VDC AGC SUPPLY	X	X	X	X	X	X		
CG1031V	+3 VCC AGC SUPPLY NOISE RMS	X	X	X	X	X	X		
CG1032X	+3 VCC AGC SUPPLY NOISE PEAK	X	X	X	X	X	X		
CG1100V	-28 VDC SUPPLY	X	X	X	X	X	X		
CG1201V	IMU 28V .8KC 1 PCT 0 DEG SUP RMS	X	0	0	0	0	0		
CG1202V	IMU 28V .8KC 5 PCT-90DEG SUP RMS	X	X	X	X	X	X		
CG1203V	IMU 28V .8KC 5 PCT 0 DEG SUP RMS	X	X	X	X	X	X		
CG1204V	CDU 28V .8KC 5 PCT-90DEG SUP RMS	X	X	X	X	X	X		
CG1206B	PH DIFF IMU 1-5 PCT 0--90 DEG	X	X	X	X	X	X		
CG1207B	PH DIFF IMU 5-5 PCT -90-0 DEG	X	X	X	X	X	X		
CG1209B	PH DIFF CDU 5P 90D IMU 1P 0 DEG	X	X	X	X	X	X		
CG1211V	OPTX 28V .8KC 1PCT 0 DEG SUP RMS	X	X	X	X	X	X		
CG1212V	OPTX 28V .8KC 5 PCT -90D SUP RMS	X	X	X	X	X	X		
CG1216B	PH DIFF OPTX 1-5 PCT 0--90 DEG	X	X	X	X	X	X		
CG1220B	PH DIFF OPTX 1PCT / IMU 1PCT	X	X	X	X	X	X		
CG1301V	IMU 2V 3200 CPS SUPPLY RMS	X	X	X	X	X	X		
CG1302V	20V 3.2KC SQ WAVE SUPPLY RMS	X	X	X	X	X	X		
CG1306B	PH DIFF IMU 3.2KC AGC SYNC	X	X	X	X	X	X		
CG1400V	IMU 2V 25.6 KC SUPPLY RMS	X	X	X	X	X	X		
CG1401V	OPTX 2V 25.6 KC SUPPLY RMS	X	X	X	X	X	X		
CG1402B	IN PHASE IMU 25.6 / OPTX 25.6	X	X	X	X	X	X		

MEAS ID	MEASUREMENT DESCRIPTION	SPACECRAFT 006	008	011	012	014	015	017	020
CG1500V	+28 VDC BUS 1	X	X	X	X	X	X		
CG1501V	+28 VDC BUS 1 NOISE RMS	X	X	X	X	X	X		
CG1502X	+28 VDC BUS 1 NOISE PEAKS	X	X	X	X	X	X		
CG1510V	+28 VDC BUS 2	X	X	X	X	X	X		
CG1511V	+28 VDC BUS 2 NOISE RMS	X	X	X	X	X	X		
CG1512X	+28 VDC BUS 2 NOISE PEAKS	X	X	X	X	X	X		
CG1520V	+28 VDC BUS 3	X	X	X	X	X	X		
CG1521V	+28 VDC BUS 3 NOISE RMS	X	X	X	X	X	X		
CG1522X	+28 VDC BUS 3 NOISE PEAKS	X	X	X	X	X	X		
CG1530V	+28 VDC BUS 4	X	X	X	X	X	X		
CG1531V	+28 VDC BUS 4 NOISE RMS	X	X	X	X	X	X		
CG1532X	+28 VDC BUS 4 NOISE PEAKS	X	X	X	X	X	X		
CG2000V	X PIPA S G OUTPUT RMS	X	X	X	X	X	X		
CG2001B	X PIPA S G OUTPUT IN PHASE	X	X	X	X	X	X		
CG2002B	X PIPA S G OUTPUT QUAD	X	X	0	0	0	0		
CG2020V	Y PIPA S G OUTPUT RMS	X	X	X	X	X	X		
CG2021B	Y PIPA S G OUTPUT IN PHASE	X	X	X	X	X	X		
CG2022B	Y PIPA S G OUTPUT QUAD	X	X	0	0	0	0		
CG2040V	Z PIPA S G OUTPUT RMS	X	X	X	X	X	X		
CG2041B	Z PIPA S G OUTPUT IN PHASE	X	X	X	X	X	X		
CG2042B	Z PIPA SG OUTPUT QUAD	X	X	0	0	0	0		
CG2107B	IGA SERVO ERROR IN PHASE	X	X	X	X	X	X		
CG2108B	IGA SERVO ERROR QUAD	X	X	X	X	X	X		
CG2135B	Z IRIG PREAMP OUTPUT QUAD	X	X	X	X	X	X		
CG2137B	MGA SERVO ERROR IN PHASE	X	X	X	X	X	X		
CG2138B	MGA SERVO ERROR QUAD	X	X	X	X	X	X		
CG2165B	X IRIG PREAMP OUTPUT QUAD	X	X	X	X	X	X		
CG2167B	OGA SERVO ERROR IN PHASE	X	X	X	X	X	X		
CG2168B	OGA SERVO ERROR QUAD	X	X	X	X	X	X		
CG2201V	IGA CDU FAIL SIGNAL RMS	X	X	X	X	X	X		
CG2204B	IGA CDU 16X RES ERROR IN PHASE	X	X	X	X	X	X		
CG2205V	IGA CDU 16X RES ERROR RMS	X	X	X	X	X	X		
CG2207V	IGA CDU 1X RES ERROR RMS	0	0	0	X	X	X		
CG2209B	SCS PITCH IN PHASE	0	0	0	X	X	X		
CG2214V	IG DAC ERROR SIGNAL	X	X	X	X	X	X		

MEAS ID	MEASUREMENT DESCRIPTION	SPACECRAFT 006	008	011	012	014	015	017	020
CG2231V	MGA CDU FAIL SIGNAL RMS	X	X	X	X	X	X		
CG2234B	MGA CDU 16X RES ERROR IN PHASE	X	X	X	X	X	X		
CG2235V	MGA CDU 16X RES ERROR RMS	0	0	0	X	X	X		
CG2237V	MGA CDU 1X RES ERROR RMS	0	0	0	X	X	X		
CG2239B	SCS YAW BODY AXIS IN PHASE	X	X	X	X	X	X		
CG2241B	SCS YAW OFFSET AXIS IN PHASE	X	X	X	X	X	X		
CG2244V	MG DAC ERROR SIGNAL	X	X	X	X	X	X		
CG2261V	OG CDU FAIL SIGNAL RMS	X	X	X	X	X	X		
CG2264B	OGA CDU 16X RES ERROR IN PHASE	X	X	X	X	X	X		
CG2265V	OGA CDU 16X RES ERROR RMS	0	0	0	X	X	X		
CG2267V	OGA CDU 1X RES ERROR RMS	0	0	0	X	X	X		
CG2269B	SCS ROLL BODY AXIS IN PHASE	X	X	X	X	X	X		
CG2271B	SCS ROLL OFFSET AXIS IN PHASE	X	X	X	X	X	X		
CG2274V	OG DAC ERROR SIGNAL	X	X	X	X	X	X		
CG2304V	IMU TEMP CONTROL BRIDGE SUPPLY	X	X	X	X	X	X		
CG3101B	TRUN CDU 16X RES ERROR IN PHASE	X	X	X	0	0	0		
CG3103B	SXT TRUN MOTOR DRIVE QUAD	X	X	X	X	X	X		
CG3111B	SHAFT CDU 16X RES IN PHASE	X	X	X	X	X	X		
CG3120B	SCT TRUN 1X RES ERROR IN PHASE	X	X	X	X	X	X		
CG3130B	SCT SHAFT 1/2X RES ERROR IN PHAS	X	X	X	X	X	X		
CG3201B	TRUN CDU MOTOR DRIVE QUAD	X	X	X	X	X	X		
CG3206B	TRUN CDU TACH OUTPUT IN PHASE	X	X	X	X	X	X		
CG3209V	OPTX DIRECT TRUNION CONTLR IN PH	0	0	0	X	X	X		
CG3220V	SHAFT CDU MOTOR DRIVE IN PHASE	0	0	0	X	X	X		
CG3221B	SHAFT CDU MOTOR DRIVE QUAD	X	X	X	X	X	X		
CG3226B	SHAFT CDU TACH OUTPUT IN PHASE	X	X	X	X	X	X		
CG3229V	OPTX DIRECT SHAFT CONTLR IN PH	0	0	0	X	X	X		

N - 110 - H58

REVISIONS

APPENDIX B

ABBREVIATIONS

ACC	- ACCURACY
ACD	- AC TO DC CONVERTER
ACE	- ACCEPTANCE CHECKOUT EQUIPMENT
AGC	- APOLLO GUIDANCE COMPUTER
AMP	- AMPLITUDE
ANC	- AC NOISE CONVERTER
ATT	- ATTENUATED
C	- CAPACITANCE
CDU	- COUPLING DISPLAY UNIT
COND	- CONDITIONER
CONN	- CONNECTOR
D	- DEGREES
DAC	- DIGITAL TO ANALOG CONVERTER
DCA	- DC AMPLIFIER
DCD	- DC TO DC CONVERTER
DEG	- DEGREES
DIFF	- DIFFERENCE
DTCS	- DIGITAL TEST COMMAND SYSTEM
DTMS	- DIGITAL TEST MEASUREMENT SYSTEM
EXP	- EXPANDED
FREQ	- FREQUENCY
G-N	- GUIDANCE AND NAVIGATION SYSTEM
GLD	- GLITCH DETECTOR
GRD	- GROUND
ICD	- INTERFACE CONTROL DOCUMENT
ID	- IDENTIFICATION
IG	- INNER GIMBAL
IGA	- INNER GIMBAL AXIS
IMP	- IMPEDANCE
IMU	- INERTIAL MEASUREMENT UNIT
INTG	- INERTIAL RATE INTEGRATING GYROSCOPE
ISA	- ISOLATION ATTENUATOR
MEAS	- MEASUREMENT
MG	- MIDDLE GIMBAL
MGA	- MIDDLE GIMBAL AXIS
MOD	- MODULATION
NOM	- NOMINAL
NORM	- NORMAL
OG	- OUTER GIMBAL

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03983	A	MH01-01290-200

Appendix B | SHEET B-1 of B-2

REVISIONS

OGA - OUTER GIMBAL AXIS
OPTX - OPTICAL SUBSYSTEM
PCT - PERCENT
PH - PHASE
PIPA - PULSE INTEGRATING PENDULOUS ACCELEROMETER
P-P - PEAK TO PEAK
PK - PEAK
PSA - POWER AND SERVO ASSEMBLY
PSD - PHASE SENSITIVE DEMODULATOR
QUAD - QUADRATURE
R - RESISTANCE
REC - PSD REFERENCE CONDITIONER
REF - REFERENCE
REG - PSD REFERENCE GENERATOR
RES - RESOLVER
RET - RETURN
SCS - STABILIZATION AND CONTROL SYSTEM
SCT - SCANNING TELESCOPE
SEC - SECOND
SG - SIGNAL GENERATOR
SIG - SIGNAL
SQ - SQUARE
S/C - SPACECRAFT
S/S - SAMPLES PER SECOND
SUP - SUPPLY
SXT - SEXTANT
TEMP - TEMPERATURE
TOL - TOLERANCE
TRUN - TRUNNION
T/M - TELEMETRY

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01290-200
	Appendix B	SHEET B-2

REVISIONS

APPENDIX C
POLARIZATION CHART

NASA Part Number	Polarization	No. of Contacts
1010622-1	B; 45°; 90°; A	38

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH 01-01290-200
	Appendix C	SHEET C1-of 1

REVISIONS

APPENDIX A

SUMMARY OF CHARACTERISTICS OF SIGNAL CONDITIONER SUBMODULES

The analog signal conditioner submodules accept input signals in variable voltage (amplitude and phase) form and convert or condition these input signals to linearly proportionate 0 to +5 vdc output signals. The event signal conditioner submodules detect voltage levels and produce 0 or +6 vdc output signals that represent binary 0 or 1, respectively. The reference signal conditioner submodules condition the reference signal inputs for use by the phase-sensitive demodulators.

The following summarizes the characteristics of the signal conditioners used by the digital test measurement system (DTMS). Further information concerning the design of the signal conditioner is available in the procurement specifications that are referenced in the summary.

1. DC Amplifier (DCA)

Function

The dc amplifier converts low-level, dc input signals to proportionate 0 to +5 vdc output signals.

Input Signal Range

Class DCA 01	0 to +20 mvdc through 0 to +250 mvdc
Class DCA 02	0 to +250 mvdc through 0 to +5 vdc

Input Impedance

The input impedance for each amplifier is greater than 500 k ohms.

Frequency Response

The amplifiers have an output frequency response that is constant within 1 percent for input signal frequencies from dc to 15 cps.

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01290-200
	Appendix A	SHEET A-1 of A-7

FORM 2110-N-66 NEW 4-66

REVISIONS

Reference Document

Procurement specification MC 901-0261B

Set 1: Specification Control Drawing ME 901-0536

Set 2 and subs: Specification Control Drawing ME 901-0261

2. Isolation Attenuator (ISA)

Function

The isolation attenuator attenuates dc input signals to proportionate 0 to +5 vdc output signals.

Input Signal Range

Class ISA 20	0 to +5 vdc through 0 to +50 vdc
Class ISA 22	0 to -5 vdc through 0 to -50 vdc

Input Impedance

The input impedance for each attenuator is greater than 500 k ohms.

Frequency Response

Each attenuator has an output frequency response that is constant within 1 percent for input signal frequencies from dc to 15 cps.

Reference Document

Procurement specification MC 901-0260B

Set 1: Specification Control Drawing ME 901-0546

Set 2 and subs: Specification Control Drawing ME 901-0260

3. AC-to-DC Converter (ACD)

Function

The ac-to-dc converter converts sine and square wave input signals to proportionate 0 to +5 vdc output signals.

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01290-200
	Appendix A	SHEET A-2

FORM 2110-N-66 NEW 4-66

Input Signal Range

Class ACD 40	0 to 100 mvrms through 5 vrms (400 to 25,600 cps)
Class ACD 41	0 to 5 vrms through 150 vrms (400 to 3200 cps)

Input Impedance

The input impedance for each converter is greater than 500 k ohms.

Frequency Response

Each converter has an output frequency response that is constant within 1 percent for amplitude modulation rates of 0 to 60 cps.

Reference Document

Procurement specification MC 901-0278B

Set 1: Specification Control Drawing ME 901-0535

Set 2 and subs: Specification Control Drawing ME 901-0278

4. Phase-Sensitive Demodulator (PSD)

Function

The phase-sensitive demodulator produces a 0 to +5 vdc output signal that is a function of the amplitude of the input signal and the phase of the input signal with respect to a reference signal.

Input Signal Range

Class PSD 50	0 to 200 mvrms through 5 vrms, 400 to 3200 cps (cosine function)
Class PSD 51	0 to 5 vrms through 50 vrms, 400 to 3200 cps (cosine function)
Class PSD 52	0 to 200 mvrms through 5 vrms, 400 to 3200 cps (sine function, 90-degree reference shift)
Class PSD 53	0 to 5 vrms through 50 vrms, 400 to 3200 cps (sine function, 90-degree reference shift)

Class PSD 54	0 to 200 mvrms through 5 vrms, 3200 cps only (+45 degree phase shift cosine function)
Class PSD 55	0 to 200 mvrms through 5 vrms, 3200 cps only (-45 degree phase shift sine function)
Class PSD 56	0 to 1 vrms through 5 vrms, 25,600 cps (cosine function)

Input Impedance

The input impedance for each demodulator is greater than 500 k ohms.

Frequency Response

Each demodulator has an output frequency response that is constant within 1 percent for amplitude modulation rates from 0 to 60 cps.

Reference Input Signal

The reference input of each demodulator accepts the output of either a PSD reference conditioner (REC) or reference generator (REG). All phase reference signals are conditioned by either a REC or REG.

Reference Document

Procurement specification MC 901-0283B

Set 1: Specification Control Drawing ME 901-0531

Set 2 and subs: Specification Control Drawing ME 901-0283

5. AC Noise Converter (ANC)

Function

The ac noise converter is used to monitor the noise on a dc power supply. The converter provides a 0 to +5 vdc output that is proportional to the rectified average of the noise.

Input Signal Range

ANC 130	0 to 100 mvrms through 5 vrms, 50 to 10,000 cps

Input Impedance

The input impedance of the converter is greater than 500 k ohms for dc signals and greater than 100 k ohms for ac signals.

Response Time

For step changes in the input, the output converges to within 1 percent of the steady-state value in less than 0.1 second.

Reference Document

Procurement specification MC 901-0378A

Set 1: Specification Control Drawing ME 901-0534

Set 2 and subs: Specification Control Drawing ME 901-0378

6. Glitch Detector (GLD)

Function

The glitch detector monitors a dc power supply and indicates if it receives a noise spike greater than a predetermined threshold level. The threshold level is adjustable and has a tolerance of ±400 mvdc. After receiving a spike of sufficient amplitude, the detector remains in the ON condition until the output is sampled and the detector is reset to the OFF condition by the trailing edge of the sampling pulse.

Input signal Range Logic Levels

GLD 160	ON--noise spikes above threshold level to ±50 volt peak maximum. The threshold level is adjustable in the range of ±1 volt peak through ±5 volt peak. OFF--input signal below threshold level.

Input Impedance

The input impedance of the detector is greater than 500 k ohms.

Reference Document

Procurement specification MC 901-0359A

Set 1: Specification Control Drawing ME 901-0538

Set 2 and subs: Specification Control Drawing ME 901-0359

7. PSD Reference Conditioner (REC)

Function

The PSD reference conditioners provide impedance transformation and amplification or attenuation, as required for reference signals to the phase-sensitive demodulators.

Input Signal Range

Class REC 800	2 to 32 vrms, 800 cps
Class REC 3200	2 to 32 vrms, 3200 cps
Class REC 25.6	2 to 32 vrms, 25,600 cps

Input Impedance

The input impedance of each conditioner is greater than 1 megohm.

Reference Document

Procurement specification MC 901-0362A

Set 1: Specification Control Drawing ME 901-0532

Set 2 and subs: Specification Control Drawing ME 901-0362

8. PSD Reference Generator (REG)

Function

The PSD reference generator accepts set and reset pulses and generates a square-wave reference signal for phase-sensitive demodulators.

Output Reference Signals

Class REG 3200 — 3200 cps reference output

Input Impedance

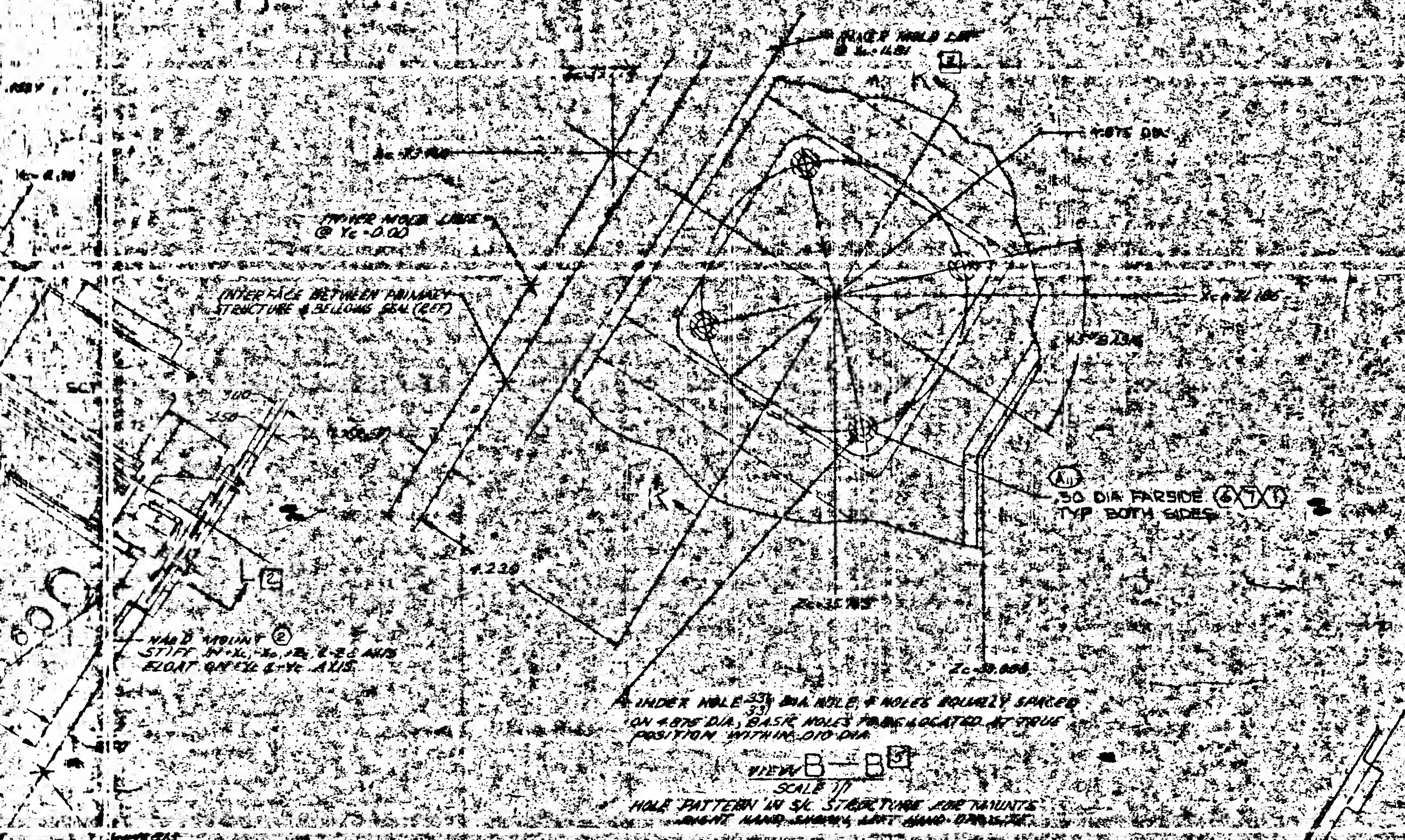
The input impedance of the reference generator is greater than 50 k ohms.

Reference Document

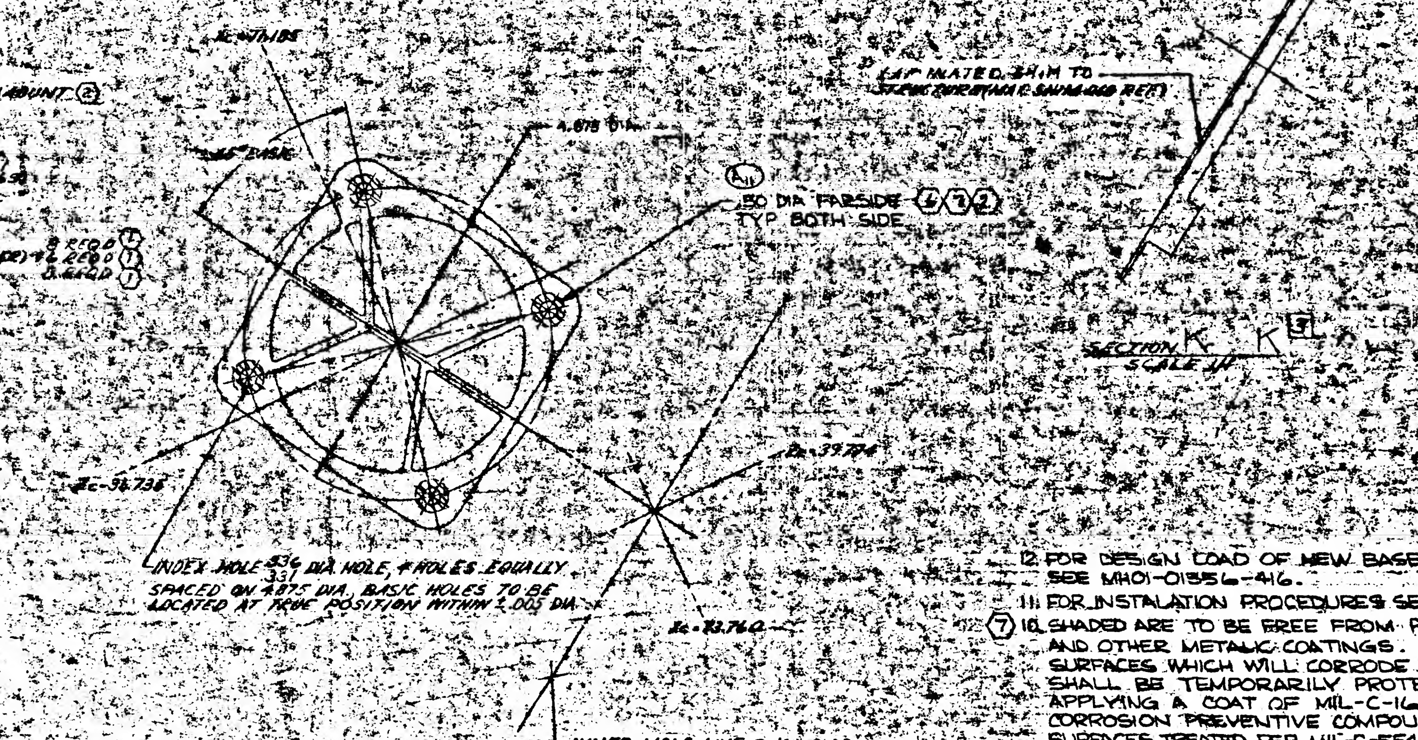
Procurement specification MC 496-0012A

Set 1: Specification Control Drawing ME496-0025

Set 2 and subs: Specification Control Drawing ME496-0012

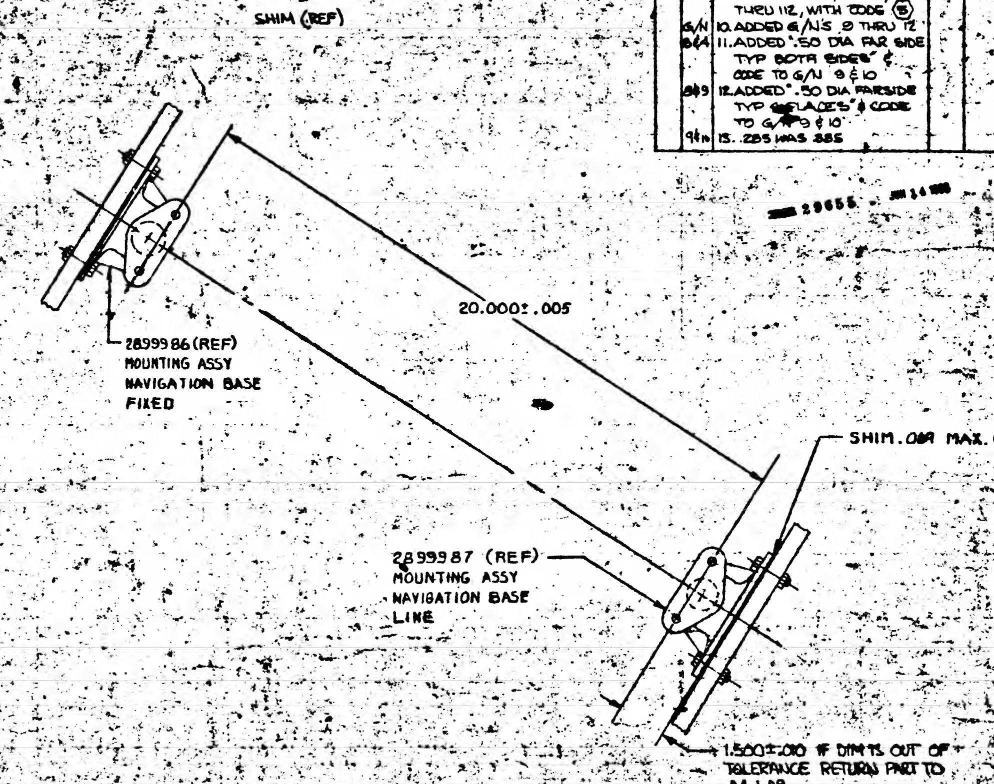


VIEW B—B 5
SCALE 1/1
HOLE PATTERN IN S/C STRUCTURE FOR MOUNTS



SECTION C—C 5
SCALE 1/1
HOLE PATTERN IN MOUNT TYPICAL
2 PLACES
RIGHT HAND SHOWN, LEFT HAND OPPOSITE

SECTION K—K 5
SCALE 1/1



VIEW L-L 5
SCALE 1/2
NAV BASE HAS BEEN OMITTED FOR CLARITY

REVISIONS

SYM	ZONE	DESCRIPTION	REQD BY	REF
A	6	1. 11.505, 11.495 DIM TO NVB. MOUNT INTERFACE WAS 11.567, 11.557 DIM TO HARD MOUNT STRUCT. INTERFACE ⑥ IRN 0080		
	6	2. 23.010, 22.990 MOUNT TO MOUNT WAS 23.135, 23.115 ⑥ IRN 0080		
	5	3. LAMINATED SHIM TO STRUCTURE ① (MAX. SHIM .069) WAS LAMINATED SHIM BONDED TO STRUCTURE ① (MAX. SHIM .060) IRN 0080		
	8	4. DIM. 1.500 WAS 1.50 IRN 0080		
	3	5. DELETED GEN NOTE 5 & CODE ④ IRN 0080		
	2&5	6. ADDED VIEW L-L & DIM.		
	F/D	7. CHANGED R.H. & L.H. MOUNTS TO BLOCK 2 WAS BLOCK 1	NAA	
	F/D	8. CHANGED BELLOWS TO BLOCK 2 WAS BLOCK 1	MIT	
	G/N	9. DELETED G/N #7 AIR FRAMES 2H-1, 2TV-1, 101 THRU 112, WITH CODE ⑤		
	G/N	10. ADDED G/N'S 9 THRU 12		
	6&4	11. ADDED ".50 DIA FAR SIDE TYP BOTH SIDES" & CODE TO G/N 9 & 10		
	8&9	12. ADDED ".50 DIA FARSIDE TYP 2 PLACES" & CODE TO G/N 9 & 10		
	9&10	13. .285 WAS .385		

29655 JUN 14 1966

12. FOR DESIGN LOAD OF NEW BASE & OPTICS SEE MH01-01356-416.
11. FOR INSTALATION PROCEDURES SEE MH01-01380-416
⑦ 10. SHADED ARE TO BE FREE FROM PAINT PRIMER AND OTHER METALIC COATINGS. BARE METAL SURFACES WHICH WILL CORRODE OR OXIDIZE SHALL BE TEMPORARILY PROTECTED BY APPLYING A COAT OF MIL-C-16173, GRADE 4 CORROSION PREVENTIVE COMPOUND. ALUMINUM SURFACES TREATED PER MIL-C-5541 WITH IRRIDITE 14-2 OR ALODINE 1200S NEED NO OTHER PROTECTION
⑥ 9. ELECTRICAL BONDING-DC RESISTANCE ACROSS MATED METALIC SURFACES SHALL BE LESS THAN 10 MILLIOHMS.
8. PART NUMBERS SHOWN FOR REF ONLY.
7.
6. FOR CONNECTORS & CABLING SEE ICD MH01-01306-116.
5. ALL REFERENCES TO X,Y & Z ARE THEORETICAL LOCATIONS.
③ 4. SURFACE FINISH 32/ PER MIL-STD-10
② 3. MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT) CAMBRIDGE, MASSACHUSETTS
① 2. NORTH AMERICAN AVIATION INC., SPACE & INFORMATION SYSTEMS DIVISION (S&ID) DOWNEY, CALIFORNIA
1. THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN
NOTES: UNLESS OTHERWISE SPECIFIED

MODEL NO.	PART NO.	DESCRIPTION	APPLICABLE SPECIFICATIONS
EFFECTIVITY AND SPECIFICATIONS			
INTERFACE CONTROL DOCUMENT			

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS .XX = ± .03, .XXX = ± .010; ANGLES ± 30'

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

DO NOT SCALE

DR BY	L. HINKEL		2-26-65
CHK BY			
AUTH SIGNATURE		REP	DATE
[illegible]		NAA	7/14/65
[illegible]		MIT	16 July 65

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

BLOCK II, G&N NAVIGATIONAL BASE & OPTICS ASSY TO COMMAND MODULE STRUCTURE-MTG & INSTL

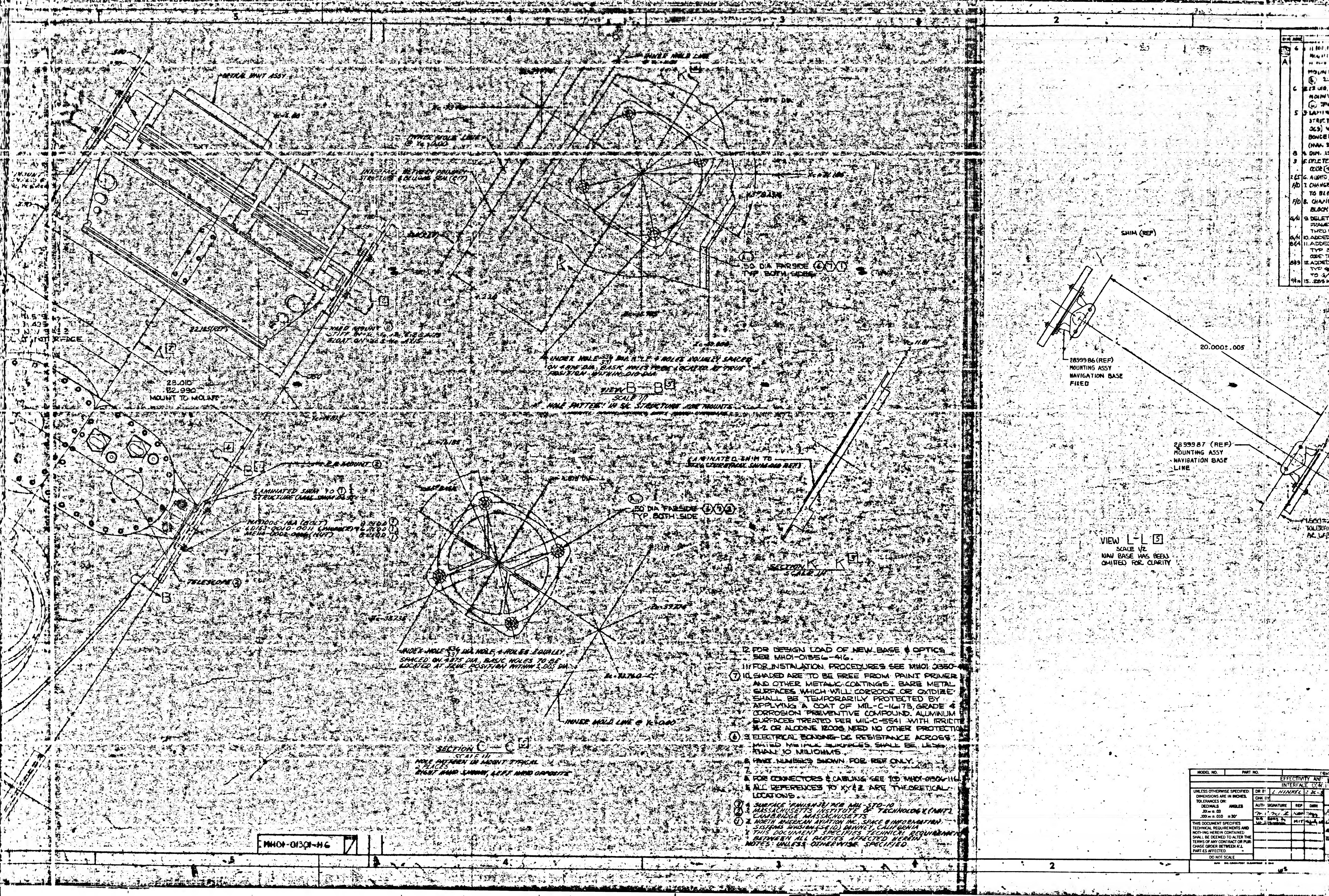
CODE IDENT NO.	SIZE	
03953	J	MH01-01301-116

SCALE NOTED | SHEET

MH01-01301-116 7

22A

F-5



12. FOR DESIGN LOAD OF NEW BASE & OPTICS SEE MH01-01356-416.
11. FOR INSTALATION PROCEDURES SEE MH01-01350-416.
10. SHADED ARE TO BE FREE FROM PAINT PRIMER AND OTHER METALIC COATINGS. BARE METAL SURFACES WHICH WILL CORRODE OR OXIDIZE SHALL BE TEMPORARILY PROTECTED BY APPLYING A COAT OF MIL-C-16173, GRADE 4 CORROSION PREVENTIVE COMPOUND. ALUMINUM SURFACES TREATED PER MIL-C-5541 WITH IRRIDITE 14-2 OR ALODINE 1200S NEED NO OTHER PROTECTION.
9. ELECTRICAL BONDING-DC RESISTANCE ACROSS MATED METAL SURFACES SHALL BE LESS THAN 10 MILIOHMS.
8. PART NUMBERS SHOWN FOR REF ONLY.
7.
6. FOR CONNECTORS & CABLING SEE ICD MH01-01306-116.
5. ALL REFERENCES TO X, Y & Z ARE THEORETICAL LOCATIONS.
4. SURFACE FINISH 32/ PER MIL-STD-10
3. MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT) CAMBRIDGE, MASSACHUSETTS
2. NORTH AMERICAN AVIATION INC., SPACE & INFORMATION SYSTEMS DIVISION (S&ID) DOWNEY, CALIFORNIA
1. THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN
NOTES: UNLESS OTHERWISE SPECIFIED

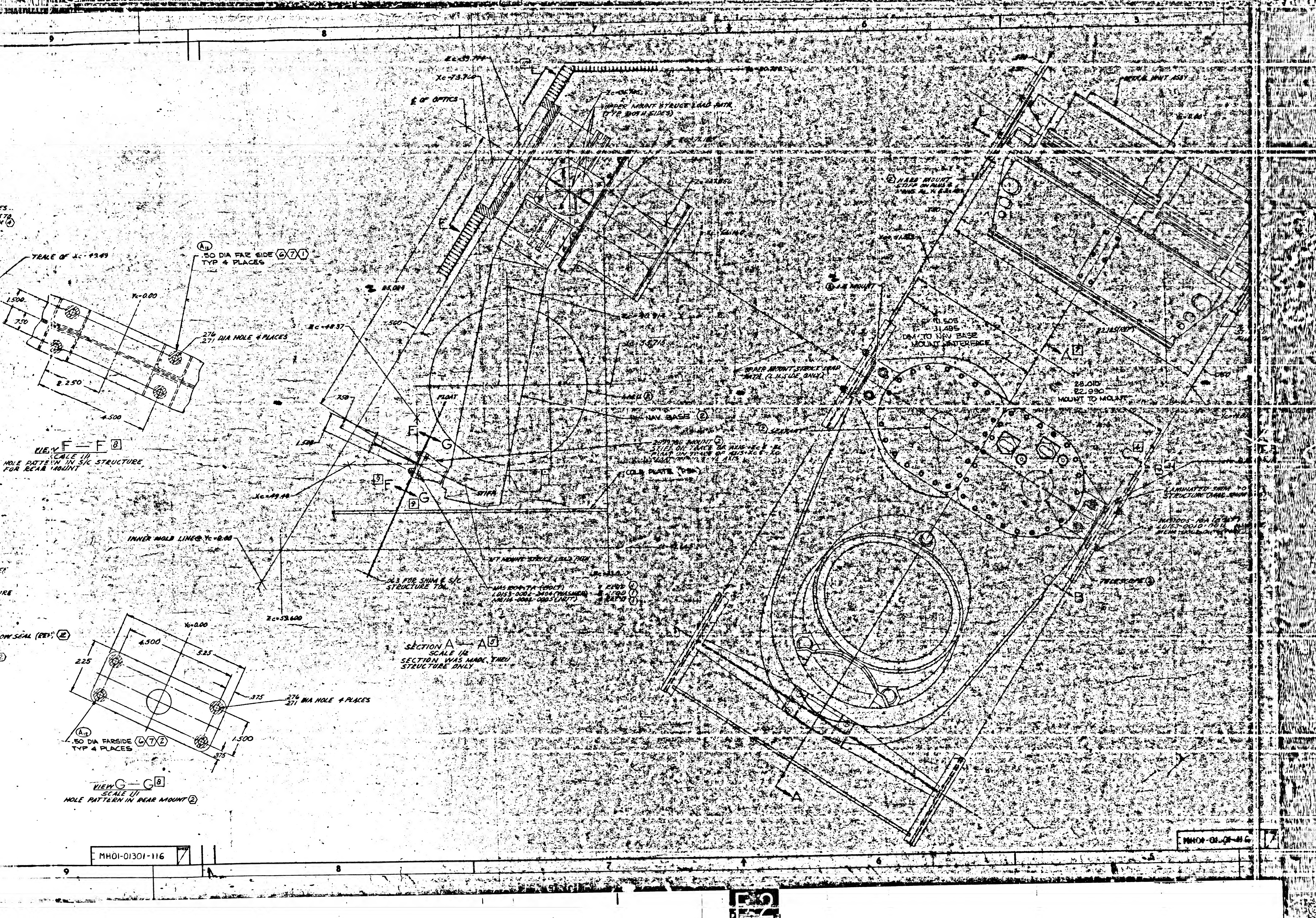
MODEL NO.	PART NO.
EFFECTIVITY AN	
INTERFACE CON	

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS .XX = ± .03 .XXX = ± .010 ANGLES ± 30'

DR BY L. HINKEL

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED.

DO NOT SCALE



Zc-39.774
Xc-73.740
℄ OF OPTICS
UPPER MOUNT STRUCT LOAD PATH (TYP BOTH SIDES)
HARD MOUNT STIFF ON PLUS & MINUS
OPTICAL MNT ASSY
Zc 35.084
Zc-48.37
.560
.750
1.500
FLOAT
11.505
11.495
DIM TO NAV BASE MOUNT INTERFACE
22.125(REF)
28.010
27.990
MOUNT TO MOUNT
UPPER MOUNT STRUCT LOAD PATH (L.H. SIDE ONLY)
NAV BASE ②
COLD PLATE
STIFF
Xc-49.49
INNER MOLD LINE @ Yc-0.00
.063 FOR SHIM & S/C STRUCTURE TOL
AFT MOUNT STRUCT LOAD PATH
Zc-53.600
LAMINATED SHIM TO STRUCTURE
TELESCOPE ②
SECTION A — A 5
SCALE 1/2
SECTION WAS MADE THRU STRUCTURE ONLY
TRACE OF Xc-49.49
A12
.50 DIA FAR SIDE ⟨6⟩⟨7⟩⟨1⟩
TYP 4 PLACES
Yc-0.00
1.500
.750
.276
.271 DIA HOLE 4 PLACES
2.250
4.500
VIEW F — F 8
SCALE 1/1
HOLE PATTERN IN S/C STRUCTURE FOR REAR MOUNT
Yc-0.00
4.500
5.25
225
.375
.276
.271 DIA HOLE 4 PLACES
1.500
.375
A12
.50 DIA FARSIDE ⟨6⟩⟨7⟩⟨2⟩
TYP 4 PLACES
VIEW G — G 8
SCALE 1/1
HOLE PATTERN IN REAR MOUNT ②
MH01-01301-116
9
8
7
6
5

*10-32 UNF-3B THD. 9 EQUALLY SPACED ON 5.375 DIA. BASIC, THD. HOLES TO BE LOCATED AT TRUE POSITION WITHIN .005 DIA, .285 MIN FULL THD.

*10-32 UNF-3B THD. 15 PLACES EQUALLY SPACED ON 9.375 DIA BASIC, THD. HOLES TO BE LOCATED AT TRUE POSITION WITHIN .005 DIA, .285 MIN. FULL THD.

9.000(REF)
Yc=0.00
3.500(REF)
5.375 DIA
4.875 DIA
6.875 DIA
8.875 DIA
10.875 DIA
9.375 DIA
SCT BELLOWS ASSY (2)
SXT BELLOWS ASSY (2)

VIEW D—D [10]
SCALE 1/2
HOLE PATTERNS IN SXT & SCT BELLOWS FOR MOUNTING TO S/C STRUCTURE

3.950 R.
3.350 R.
201 209 DIA HOLES THRU STRUCTURE; 9 HOLES EQUALLY SPACED ON 5.375 DIA. BASIC HOLES TO BE LOCATED AT TRUE POSITION WITHIN .005 DIA (4)
Yc=0.00
.900
3.500
5.950 R.
201 209 DIA. HOLES THRU STRUCTURE; 15 HOLES EQUALLY SPACED ON 9.375 DIA BASIC, HOLES TO BE LOCATED AT TRUE POSITION WITHIN .005 DIA (4)
5.350 R.
NAS1003-1H (BOLT) 24 REQD (1)
LD153-0002-0903 (WASHER) 24 REQD (1)
INSTALL WITH MS20995N32 LOCK WIRE
PER LA01H-001 (1)

VIEW E—E [7]
SCALE 1/2
HOLE PATTERNS IN S/C STRUCTURE FOR CUT & DRILLING
(OUTER SKIN & DOORS REMOVED FOR CLARITY)

TRACE OF Yc=13.49
(A12) .53 DIA FAR SIDE TYP 4 PLACES
1.500
.750
Yc=0.00
2.250
4.500
.27 .29 DIA HOLE

VIEW F—F [8]
SCALE 1/1
HOLE PATTERN IN S/C STRUCTURE FOR REAR MOUNT

Zc=-39.774
Yc=13.760
Xc=.760
.150
.560
6.000 DIA
8.000 DIA
1.000(REF)
D
INNER MOLD LINE
INTER FACE SURFACE BETWEEN PRIMARY STRUCTURE & BELLOWS SEALS (3)
SCT
SXT
10.000 DIA
9.000 DIA
Yc=7.60
Zc=27.856
Yc=66.160
14.50

SECTION H—H [10]
SCALE 1/2
SECTION WAS MADE THRU STRUCTURE, SCT BELLOWS & SEAL NOT SHOWN

19.690 DIA(REF)
9.375 DIA(REF)
9.690 DIA(REF)
8.875 DIA(REF)
S/C STRUCTURE
.50 MIN CLEARANCE BETWEEN CAM INSULATION AND OPTICS HEAD (TYP)
.250 INSULATION WALL
.285 MIN THREAD
.150
INNER FACE OF DOOR PANEL
OUTER FACE S/C INNER STRUCTURE
SXT BELLOWS ASSY (2)
NAS1003-1H (BOLT) REF
S/C STRUCTURE
BELLOW SEAL (REF) (2)
BELLOWS (REF) (2)

SECTION J—J [10]
SCALE 2/1
INSTALLATION OF BELLOWS TO S/C STRUCTURE (TYPICAL) FOR SXT & SCT

INNER MOLD LINE Yc=7.60
Xc=
Zc=
Yc=0.00
4.500
5.25
225
.375
1.500
.375
(A12) .50 DIA FARSIDE (4)(7)(2) TYP 4 PLACES

VIEW G—G [8]
SCALE 1/1
HOLE PATTERN IN REAR MOUNT (2)

MH01-01301-116

AUTHORIZED SIGNATURES	REPRESENTING	DATE
W. J. Schuler	NAA-S&ID	11/16/65
D.G. Hoag by W. Stamaris	MIT/IL	5 Nov 65

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

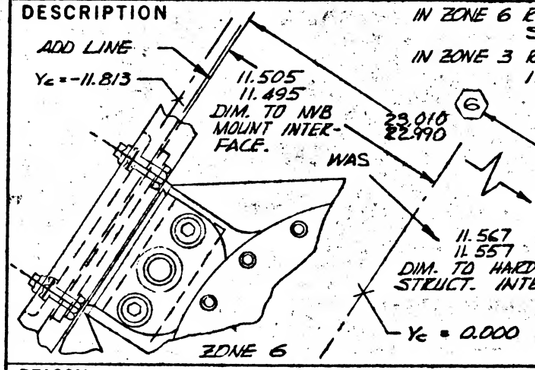
CODE IDENT. NO. 03953 | IRN NO. 10080

ICD NO.: MH01-01301-116

TITLE: BLOCK II G&N NAV. BASE & OPTICS ASSY TO C/M STRUCTURE. MIT - NAA, S&ID

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ASSOCIATE CONTRACTOR

DESCRIPTION



IN ZONE 6 REVISE & ADD DIMS. AS SHOWN; REMOVE SYMBOL (6)

IN ZONE 3 REMOVE GEN. NOTES 5 AND 9 AND REVISE ITEMS 1 AND 2 AS NOTED.
ADDED DIM 23.010/22.990 MOUNT TO MOUNT

(6) REMOVE THIS SYMBOL

ITEM 1 (ZONE 5)
LAMINATED SHIM TO STRUCTURE (1)
(MAX. SHIM .069)
WAS
LAMINATED SHIM BONDED TO STRUCTURE (MAX. SHIM .060) (1)

ITEM 2 (ZONE 8)
IN VIEW G-G DIM 1.500 WAS 1.50

REASON: TOOLING REQUEST TO CLARIFY DIMS.

DR. BY H. BECK

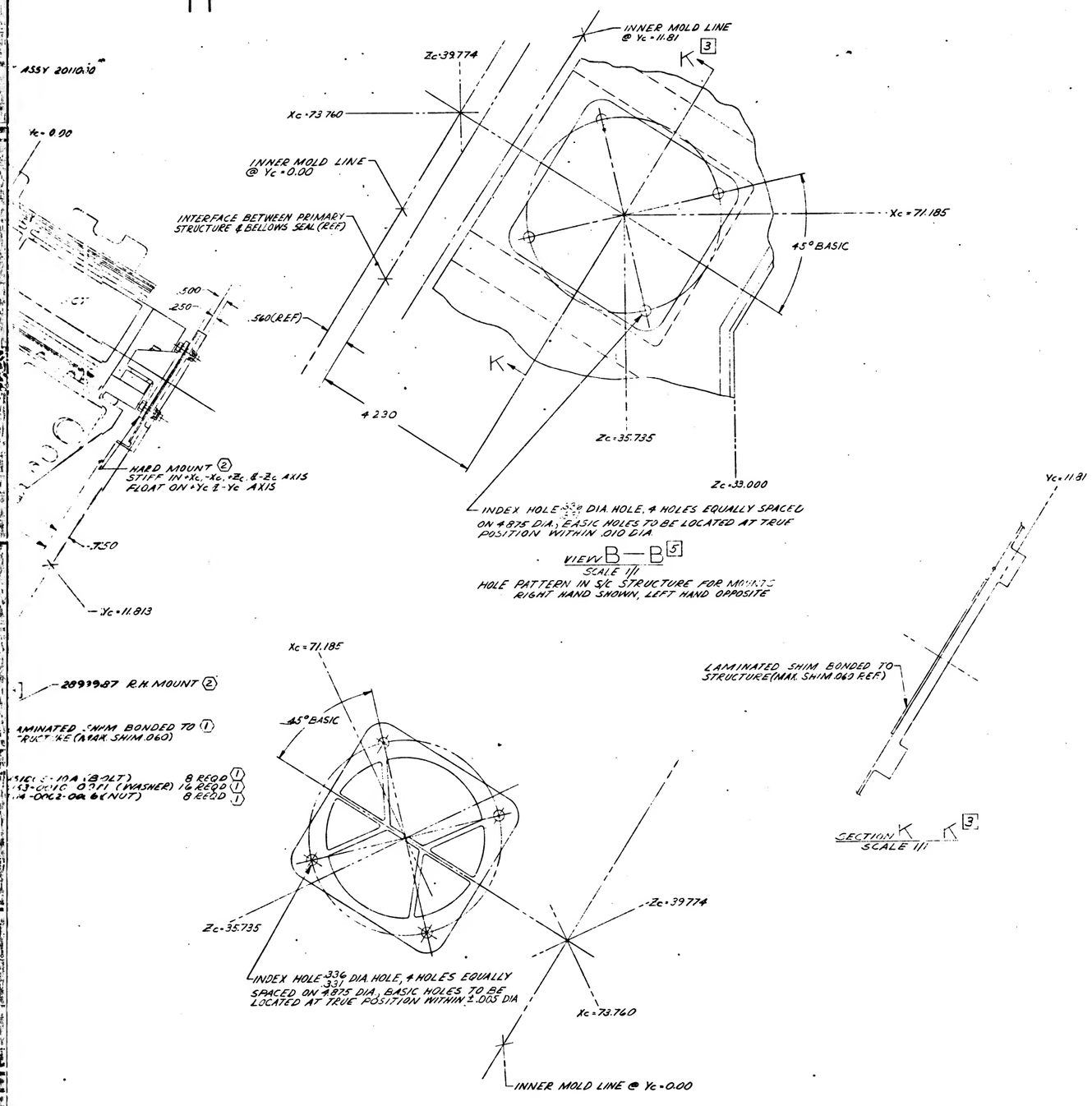
FORM M 116-N-56 REV 7-65

IDRF 24052 NOV 16 1965

REVISIONS					
SYM	ZONE	DESCRIPTION	REQD BY	REP	DATE	APPROVED
		[illegible] AUG 31 1966				

POOR SEPIA

ASSY 2011010



INDEX HOLE .339/.331 DIA HOLE, 4 HOLES EQUALLY SPACED ON 4.875 DIA, BASIC HOLES TO BE LOCATED AT TRUE POSITION WITHIN .010 DIA

VIEW B—B [5]
SCALE 1/1
HOLE PATTERN IN S/C STRUCTURE FOR MOUNTS
RIGHT HAND SHOWN, LEFT HAND OPPOSITE

SECTION K—K [3]
SCALE 1/1

(1) 8 REQD
(1) 16 REQD
(1) 8 REQD

INDEX HOLE .339/.331 DIA HOLE, 4 HOLES EQUALLY SPACED ON 4.875 DIA, BASIC HOLES TO BE LOCATED AT TRUE POSITION WITHIN ±.005 DIA

SECTION C—C [5]
SCALE 1/1
HOLE PATTERN IN MOUNT TYPICAL 2 PLACES
RIGHT HAND SHOWN, LEFT HAND OPPOSITE

10. PART NUMBERS SHOWN FOR REF ONLY
(4) 9. DIMS ESTABLISHED BY NAA S&ID TOOL NO
(5) 8. AIRFRAMES 2N-1, 2TV-1, 101 THRU 112
7. FOR CONNECTORS & CABLING SEE ICD MH01-01306-116
6. ALL REFERENCES TO X, Y & Z ARE THEORETICAL LOCATIONS
(4) 5. DESIGN DATA REQD
(3) 4. SURFACE FINISH 32/ PER MIL-STD-10
(2) 3. MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT) CAMBRIDGE MASSACHUSETTS
(1) 2. NORTH AMERICAN AVIATION INC. SPACE & INFORMATION SYSTEMS DIVISION (S&ID) DOWNEY, CALIFORNIA
1. THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN
NOTES: UNLESS OTHERWISE SPECIFIED

MODEL NO.	PART NO.	DESCRIPTION	APPLICABLE SPECIFICATIONS
		EFFECTIVITY AND SPECIFICATIONS	
		INTERFACE CONTROL DOCUMENT	

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES ON DECIMALS XX = ± .03, XXX = ± .010, ANGLES = 30'

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

DO NOT SCALE

	AUTH SIGNATURE	REP	DATE
DR			
CHK BY			
	[illegible]		4 T 17 Jun 66

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

BLOCK II, G&N NAVIGATIONAL BASE & OPTICS ASSY TO COMMAND MODULE STRUCTURE-MITENNA-S&ID

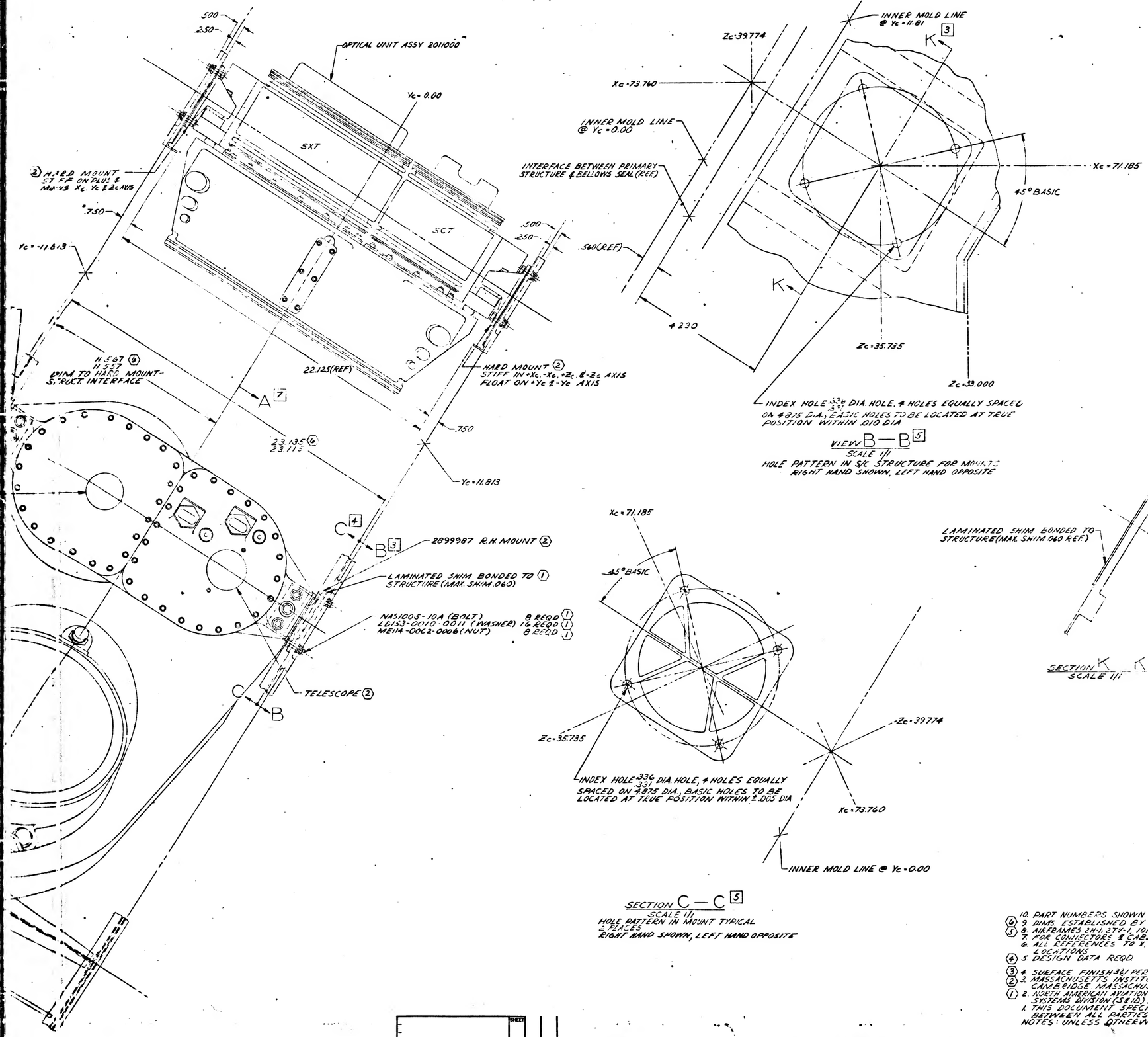
CODE IDENT NO	SIZE	
03953	J	MH01-01301-116

SCALE 1/1 SHEET

FORM NO. 31134-0 REV 1-62

SHEET

F4 MH01-01301-116



10. PART NUMBERS SHOWN FOR REF ONLY
9 DIMS. ESTABLISHED BY NAA S&ID TOOL NO
8. AIRFRAMES 2H-1, 2TV-1, 101 THRU 112
7. FOR CONNECTORS & CABLING SEE ICD MAN01-01306-116
6. ALL REFERENCES TO X, Y & Z ARE THEORETICAL LOCATIONS
5 DESIGN DATA REQD
4. SURFACE FINISH 32 PER MIL-STD-10
3. MASSACHUSETTS INSTITUTE OF TECHNOLOGY (MIT) CAMBRIDGE MASSACHUSETTS
2. NORTH AMERICAN AVIATION INC. SPACE & INFORMATION SYSTEMS DIVISION (S&ID) DOWNEY, CALIFORNIA
1. THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN
NOTES: UNLESS OTHERWISE SPECIFIED

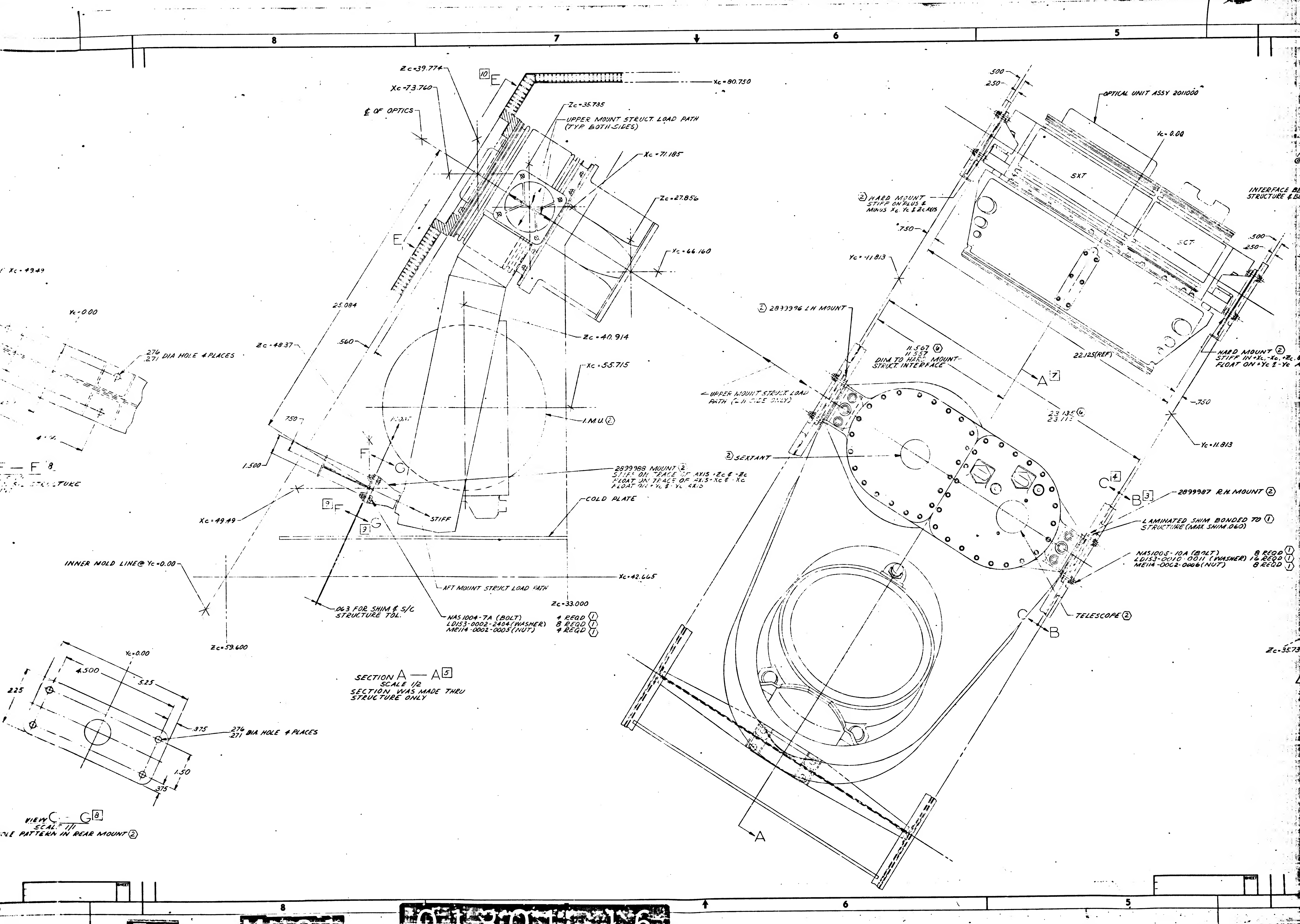
MODEL NO.	PART NO.

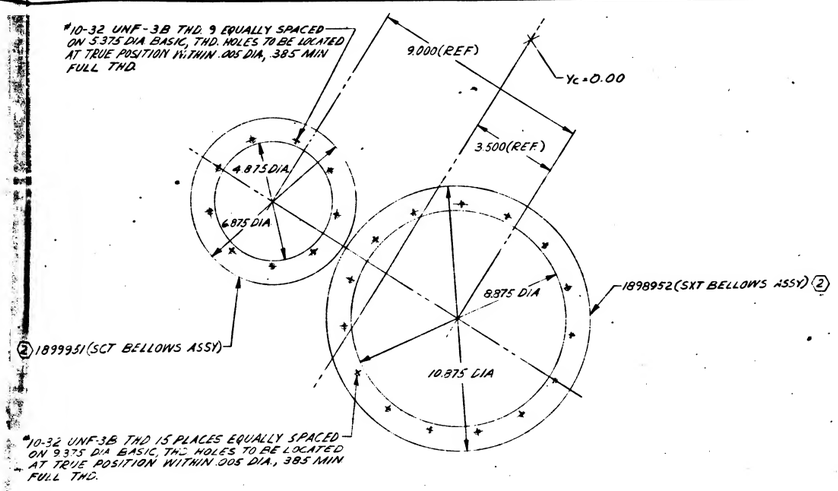
UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
TOLERANCES ON DECIMALS .XX ± .03, .XXX ± .010; ANGLES ± 30'
THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED
DO NOT SCALE

DR
CH
APP
PROJ
ENG

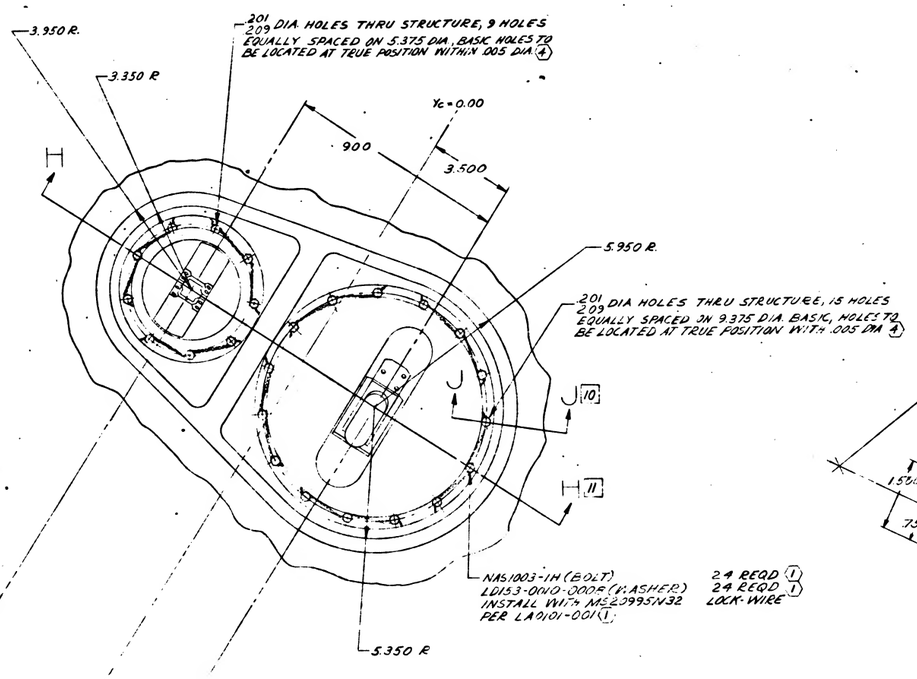
SHEET

01320 16

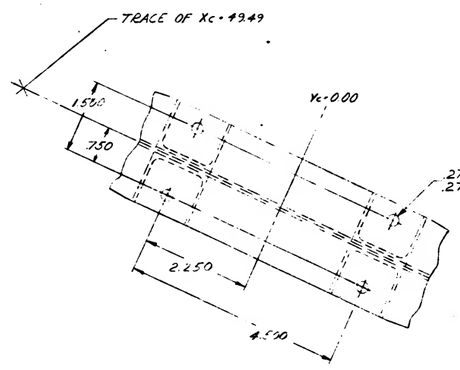

8
7
6
5
Zc=39.774
Xc=73.760
℄ OF OPTICS
Xc=80.750
Zc=35.735
UPPER MOUNT STRUCT. LOAD PATH
(TYP. BOTH SIDES)
Xc=71.185
Zc=27.856
Yc=66.160
25.084
.560
Zc=48.37
Zc=40.914
Xc=55.715
I.M.U. 2
750
1.500
FLOAT
STIFF
2899988 MOUNT 2
COLD PLATE
Xc=49.49
INNER MOLD LINE @ Yc=0.00
Xc=42.665
AFT MOUNT STRUCT LOAD PATH
Zc=33.000
.063 FOR SHIM & S/C STRUCTURE TOL.
NAS1004-7A (BOLT) 4 REQD 1
LD153-0002-2404 (WASHER) 8 REQD 1
ME114-0002-0005 (NUT) 4 REQD 1
Zc=59.600
Yc=0.00
.276
.271 DIA HOLE 4 PLACES
4.500
5.25
225
.375
1.50
VIEW G — G 8
SCALE 1/1
SECTION A — A 5
SCALE 1/2
SECTION WAS MADE THRU
STRUCTURE ONLY
.500
.250
OPTICAL UNIT ASSY 2011000
Yc=0.00
SXT
SCT
2 HARD MOUNT
STIFF ON PLUS &
MINUS Xc, Yc & Zc AXIS
.750
Yc=-11.813
2 2899996 LH MOUNT
11.567
11.557
DIM. TO HARD MOUNT STRUCT. INTERFACE
22.125(REF)
A 7
HARD MOUNT 2
23.135
23.115
Yc=11.813
2 SEXTANT
C 4
B 3
2899987 R.H. MOUNT 2
LAMINATED SHIM BONDED TO 1
STRUCTURE (MAX. SHIM .060)
NAS1005-10A (BOLT) 8 REQD 1
LD153-0010-0011 (WASHER) 16 REQD 1
ME114-0002-0006 (NUT) 8 REQD 1
TELESCOPE 2
C
B
A
Zc=35.735



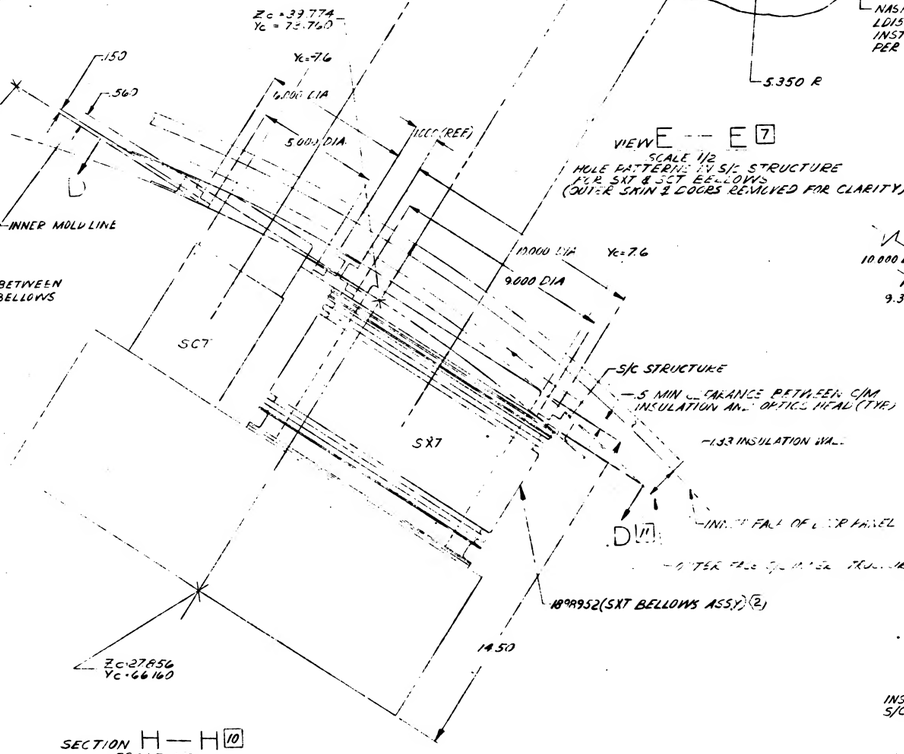
VIEW D — D [10]
SCALE 1/2
HOLE PATTERNS IN SXT & SCT BELLOWS FOR MOUNTING TO S/C STRUCTURE



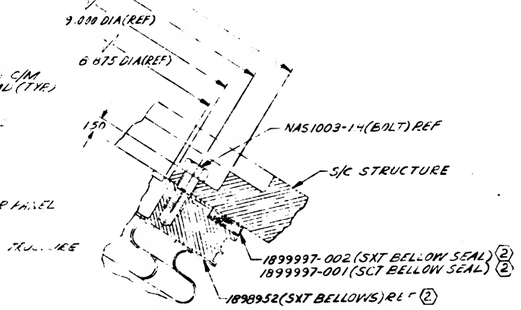
VIEW E — E [7]
SCALE 1/2
HOLE PATTERNS IN S/C STRUCTURE (FOR SXT & SCT BELLOWS)
(DUE TO SATIN & COORS REMOVED FOR CLARITY)



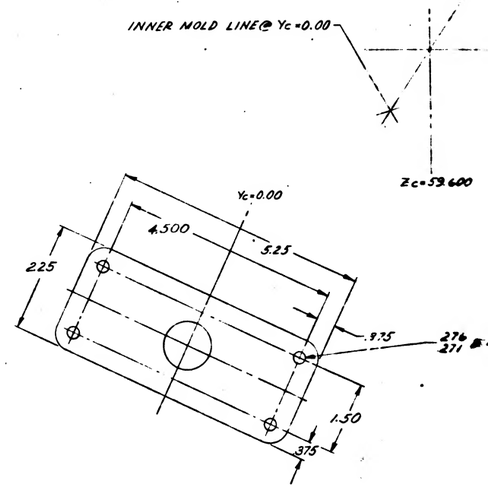
VIEW F — F [8]
SCALE 1/1
HOLE PATTERN IN S/C STRUCTURE FOR REAR MOUNT



SECTION H — H [10]
SCALE 1/2
SECTION WAS MADE THRU STRUCTURE, SCT BELLOWS & SEAL NOT SHOWN

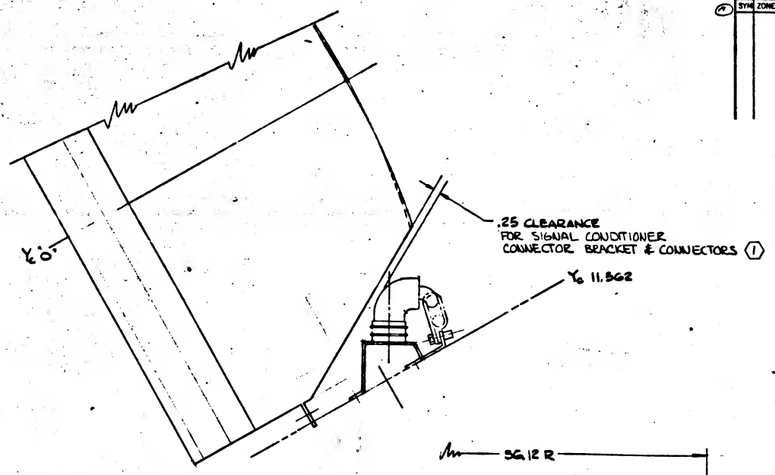


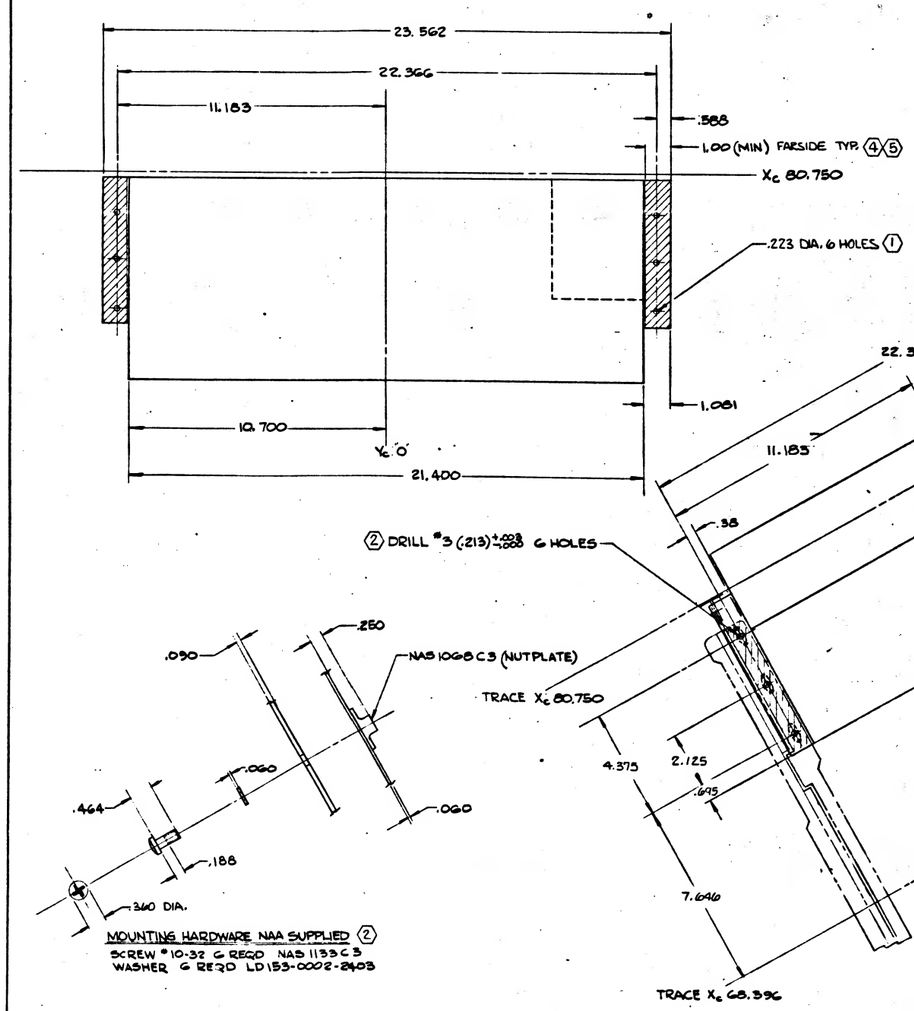
SECTION J — J [10]
SCALE 1/1
INSTALLATION OF BELLOWS TO S/C STRUCTURE (TYPICAL)

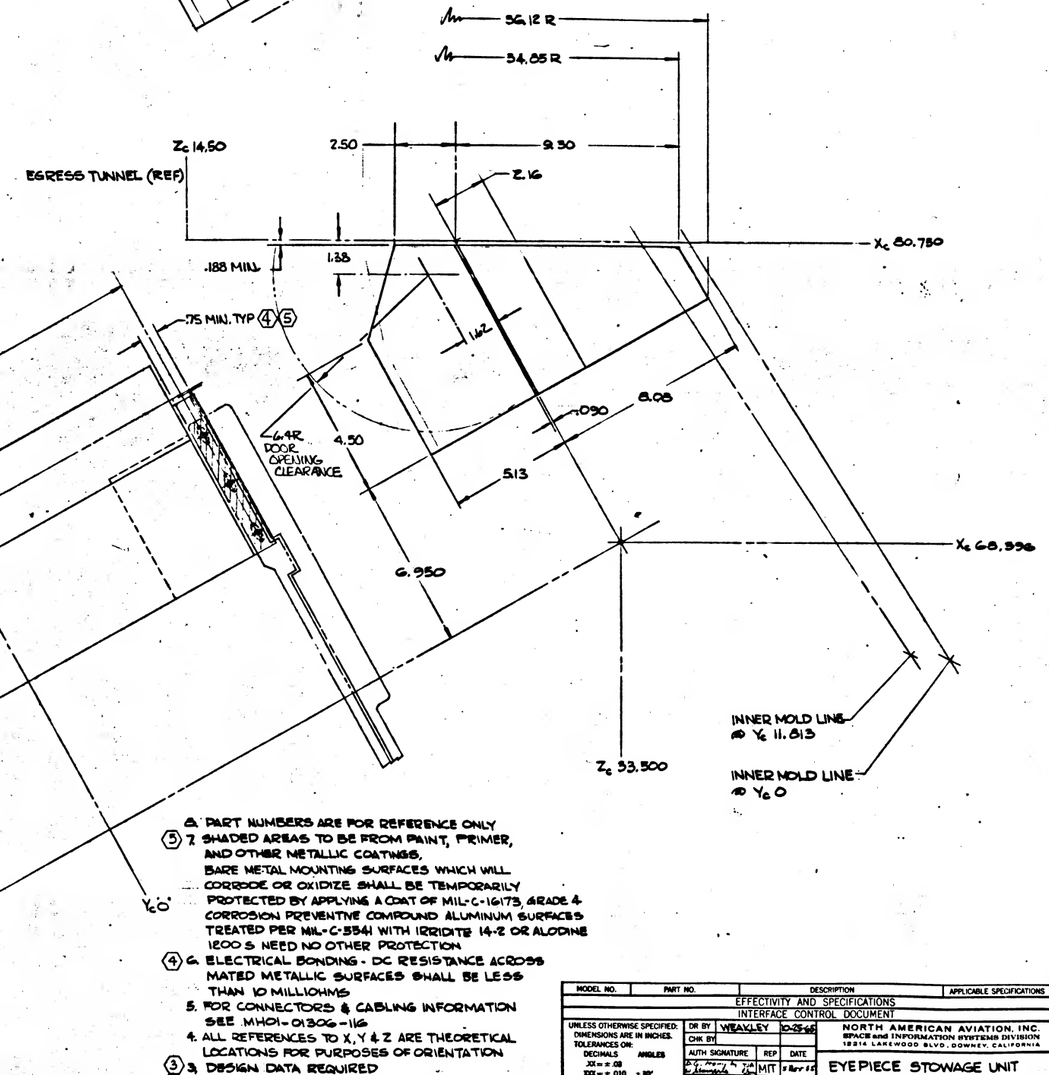


VIEW G — G [8]
SCALE 1/1
HOLE PATTERN IN REAR MOUNT (2)

REVISIONS						
SYM	ZONE	DESCRIPTION	REQD BY	REP	DATE	APPROVED







4. PART NUMBERS ARE FOR REFERENCE ONLY
(5) 7. SHADED AREAS TO BE FROM PAINT, PRIMER, AND OTHER METALLIC COATINGS. BARE METAL MOUNTING SURFACES WHICH WILL CORRODE OR OXIDIZE SHALL BE TEMPORARILY PROTECTED BY APPLYING A COAT OF MIL-C-16173, GRADE 4 CORROSION PREVENTIVE COMPOUND ALUMINUM SURFACES TREATED PER MIL-C-5541 WITH IRRIDITE 14-2 OR ALODINE 1200 S NEED NO OTHER PROTECTION
(4) 6. ELECTRICAL BONDING - DC RESISTANCE ACROSS MATED METALLIC SURFACES SHALL BE LESS THAN 10 MILLIOHMS
5. FOR CONNECTORS & CABLING INFORMATION SEE MH01-01306-116
4. ALL REFERENCES TO X, Y & Z ARE THEORETICAL LOCATIONS FOR PURPOSES OF ORIENTATION
(3) 3. DESIGN DATA REQUIRED
(2) 2. NORTH AMERICAN AVIATION INC. SPACE AND INFORMATION SYSTEMS DIVISION; DOWNEY, CALIFORNIA
(1) 1. MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MASS.
NOTES:- UNLESS OTHERWISE SPECIFIED

MODEL NO.	PART NO.	DESCRIPTION	APPLICABLE SPECIFICATIONS
EFFECTIVITY AND SPECIFICATIONS			
INTERFACE CONTROL DOCUMENT			

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS XX = ± .03, XXX = ± .010; ANGLES ± 30'

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

DO NOT SCALE

DR BY	WEAKLEY	10-25-65	
CHK BY			
AUTH SIGNATURE	REP	DATE	
[illegible]	MIT	8 Nov 65	
[illegible]	NAA	11-5-65	

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

EYEPIECE STOWAGE UNIT TO C/M STRUCTURE LEB MIT-NAA-S&ID

CODE IDENT NO.	SIZE	
03953	J	MH01-01316-116

SCALE 1/2 SHEET

MH01-01316-116

TDRR 29640 JUN 14 1966

AUTHORIZED SIGNATURES	REPRESENTING	DATE
R. Kennedy	NAA-S&ID	6/10/66
W. A. Stameris	MIT	19 May 66

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953 | IRN Nº 3614

SYM.	DOCUMENT NUMBER	REV.
A	MH01-01325-216	NC

TITLE: Total Attitude Signals MIT-NAA (Block II)

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ASSOCIATE CONTRACTOR

RELEASE DATE

COPIES TO:	DEPT.
R. Kennedy	HB29
A. Zeitlin	HB48
A. B. Kehlet	HB91
G. Gabelich	HA81
D. Niemand	HB44

DESCRIPTION

A. On sheet 4, change 2.6 (g) to read as follows:

"g. Secondary Loading = 51.1K ohms(resistive on both secondary windings) with excursions down to 37.5 K ohms due to zener limiting during momentary transients on the 800 cps reference voltage, such as at turn-on; and during periods where vehicle rate is greater than approximately 20 degrees per second."

Was: Secondary Loading = 51.1K ohms (resistive on both secondary windings)

DISTRIBUTION LIST:	Dept./Group	Location	Qty.
J. P. Yeager (NASA-MSC)	096-704	AE99	13 Copies
(MIT-IL)	096-704	AE99	4 Vellums
			2 Microdeck
Engineering Files			5 Copies

REASON: The addition of zener limiting is required by the SCS subcontractor to avoid overdriving electronic circuits due to large error voltages appearing on the secondary of the FDAI resolvers. This change is to be incorporated into the next revision of the SCS procurement specification.

DR. BY W. E. Hefner DATE 4/11/66
DEPT/GROUP 697-506 EXT. 2653
SHEET 1 OF 1

FORM M 118-N-85 REV 9-65

SYMBOLS: [A] = ATTACH IRN COPIES TO DRAWINGS

REVISIONS

TDRR 21387 AUG 6 1965

MH01-01325-216

APPROVALS

AUTHORIZED SIGNATURES	REPRESENTING	DATE
R. S. Millikin	NAA/SID	1-15-65
D. G. Hoag	MIT	5 May 65

INTERFACE CONTROL DOCUMENT

DR BY A. Silagyi

CHK BY

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

TOTAL ATTITUDE SIGNALS
MIT - NAA (BLOCK II)

CODE IDENT NO.	SIZE	
03953	A	MH01-01325-216

SHEET 1 OF 9

FORM MIIO-M-57 REV 4-65

REVISIONS

SYM	DESCRIPTION	REQD	REP	DATE	APPROVED

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01325-216

SHEET 2

REVISIONS

NOTES: Unless otherwise specified

1. Massachusetts Institute of Technology, Cambridge, Massachusetts.
2. North American Aviation, Inc., Space and Information Systems Division, Downey, California.
3. Design data required.

1.0 Scope

This document specifies the pertinent parameters describing a set of electrical signal interfaces between MIT's inertial measurement unit (IMU) and NAA's flight director attitude indicator (FDAI) and attitude set resolver. Electrical signals generated in the IMU contain information about the three gimbal angles (total attitude information.) The signals are to be loaded by specified loads in the FDAI and the attitude set resolver. (See Figure #2)

2.0 Interface Signal Characteristics

Primary mode of operation shall be using the inertial measurement unit to send total attitude information to the FDAI. The information shall be sent as six ground isolated, modulated, ac signals proportional to the sine and cosine of the actual IMU inner gimbal angle (Aig), middle gimbal angle (Amg) and outer gimbal angle (Aog). Interface pins are identified with each signal on Figure 3, Sheet 9.

2.1 Signal Voltage Definitions

$E_a = V_{max} \sin(\omega t + \theta_1) \sin A_g$ = sine winding

$E_b = V_{max} \sin(\omega t + \theta_2) \cos A_g$ = cosine winding

$E_R = E_o \sin \omega t$ = 800 cps reference as defined by ICD MH01-01324-216

Where: V_{max} = 26 volts RMS ± 10%

E_o = 28 volts RMS ± 5%

A_g = IMU gimbal angles = Aig, Amg, Aog

θ_1, θ_2 = Phase angle of the sine and cosine winding voltages with respect to the reference signal.

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01325-216

SHEET 3

REVISIONS

2.2 Null Voltage

The total null voltages of each winding as measured by a VTVM will be equal to or less than 150 millivolts. The harmonic portion of this null voltage shall not exceed 33 millivolts rms.

2.3 Phase Shift

The Phase shift (θ_1 and θ_2) with respect to the reference will be plus 6 degrees ± 5 degrees, except as modified by quadrature near sine or cosine null. The phase shift between E_a and E_b will be equal to or less than 5 degrees, that is:

$$|\theta_1 - \theta_2| \leq 5 \text{ degrees}$$

2.4 Functional Error

For any one axis, the functional error, ϵ, is defined as

$$\epsilon = A_g - \arctan \frac{E_a}{E_b}$$

where A_g is generated by rotation of the IMU case starting from all gimbal angles equal to zero. When measured at A_g = ± 30°, ± 45°, and ± 60°, the absolute value of functional error shall not exceed 0.5 degrees, i.e.

$$\epsilon \leq 0.5°$$

2.5 Nominal Source Impedance

The nominal source impedance will be 190 + j 150 ohms.

2.6 Load Requirements

The loads specified herein define the impedance seen from the interface looking into the NAA system. For each axis, the load on the sine and cosine signals shall be a single resolver having a 51.1 K ohm load and having the following characteristics:

a. Z_{ro} = 310 ± 15% + j 1970 ± 10% ohms
b. Z_{so} = 375 ± 15% + j 2160 ± 10% ohms
c. Phase Shift = 6.5 ± 1 degree
d. Transformation ratio = 1 ± 3%
e. Total null voltage versus rotation = 35 millivolts RMS max.
f. Impedance unbalance: ≦ 200 Arc seconds when tested per ND-1002013, Revision F
g. Secondary loading = 51.1K ohms (resistive on both secondary windings)

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01325-216

SHEET 4

2.7 Grounding and Isolation

All signal pairs, except the reference voltage, shall be isolated from ground in both systems. The reference signal shall have its low, or return, wire grounded at the source by MIT and shall be isolated from ground in the NAA system.

2.8 Signal Phasing

(a) Orientation of Axes - The electrical signals at the interface are functions of three IMU gimbal angles, A_{IG}, A_{MG}, and A_{OG} which are the inner, middle and outer gimbal angles respectively. When all three gimbal angles are zero, the axes are orthogonal and aligned with the principal command module axes as follows: (See Fig. 1.)

A_{IG} - Y or Pitch Axis
A_{MG} - Z or Yaw Axis
A_{OG} - X or Roll Axis

(b) Positive Gimbal Angles - Positive gimbal angles are defined one axis at a time measured from the position when all gimbal angles are zero. A positive gimbal angle is produced by a positive body rotation with the IMU stable member fixed. A positive body rotation is a clockwise rotation of the vehicle about a principal axis viewed from inside the vehicle out along the positive direction of that axis (see Fig. 1.)

(c) Signal Phase Definition - The signal characteristics for any gimbal axis (A_g) can be expressed as:

$E_a = V_{max} \sin(\omega t + \theta_1) \sin A_g$ = sine winding
$E_b = V_{max} \sin(\omega t + \theta_2) \cos A_g$ = cosine winding

A positive value for E_a and/or E_b is defined as being in phase with reference signal E_R and a negative value for E_a and/or E_b is defined as being out of phase with E_R. Therefore, a clockwise rotation of the vehicle about any positive principal axis yields the following:

0° to 90°
a. E_a (sine winding) in phase with E_R
b. E_b (cosine winding) in phase with E_R

90° to 180°
a. E_a (sine winding) in phase with E_R
b. E_b (cosine winding) out of phase with E_R

3.0 Backup Mode Operation

In the backup mode, the IMU transmits total attitude information to the FDAI resolvers and the attitude set resolvers. This mode shall be used only in the event the AGC has failed. G and N system may be inoperative with backup mode loads applied.

3.1 Signal Characteristics

Except as modified below, the same signals with the same characteristics as in Section 2 above shall be transmitted in the backup mode. Exceptions:

a. In the Signal Voltage Definitions of paragraph 2.1,

V_{max} = 24.5 volts RMS ± 10%

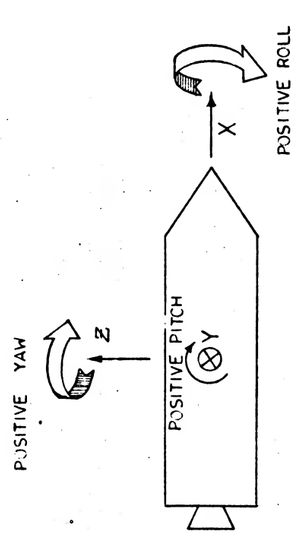
b. Phase shift of paragraph 2.3 with respect to reference shall be plus 12 degrees ±5 degrees except as modified by quadrature near sine or cosine null.

c. The phase shift between E_a and E_b and the functional error, $\mathcal{E}$, are specified only when the output winding of the attitude set resolver is within ±5 degrees of a null.

3.2 Load Requirements

The loads specified herein define the impedance seen from the interface looking into the NAA system during backup mode operation. For each axis, the load on the sine and cosine signals shall be the parallel combination of the loaded FDAI resolver as defined in paragraph 2. 6 and a single attitude set resolver shall have a load of 50 K.ohms minimum on its secondary and shall have the following characteristics when measured at a primary voltage of 24v, 800 cps:

a. Z_{po} = (300 ± 20%) + J (1820 ± 20%) ohms
b. Z_{so} = (1225 ± 20%) + J (7350 ± 20%) ohms
c. Phase shift = 4.5 ± 10 degrees
d. Transformation Ratio = 1.907 ± 0.057
e. Total null voltage vs. Rotation = 35 MV RMS (maximum)
f. Impedance unbalance ≤ 200 Arc seconds per MD1002013, Rev. F



CSM BODY AXES ≠
POSITIVE ROTATIONS

FIGURE 1

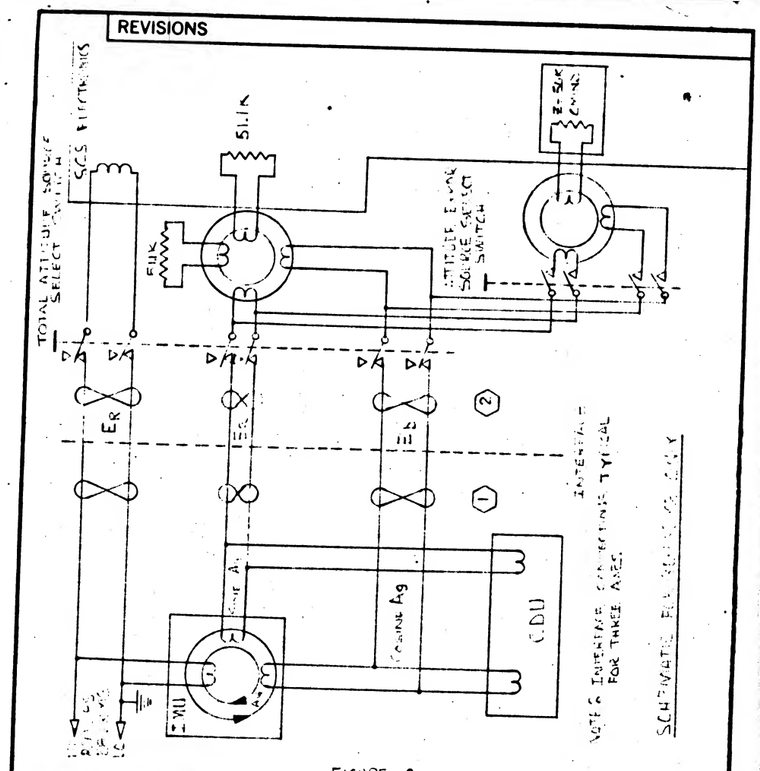


FIGURE 2

REVISIONS

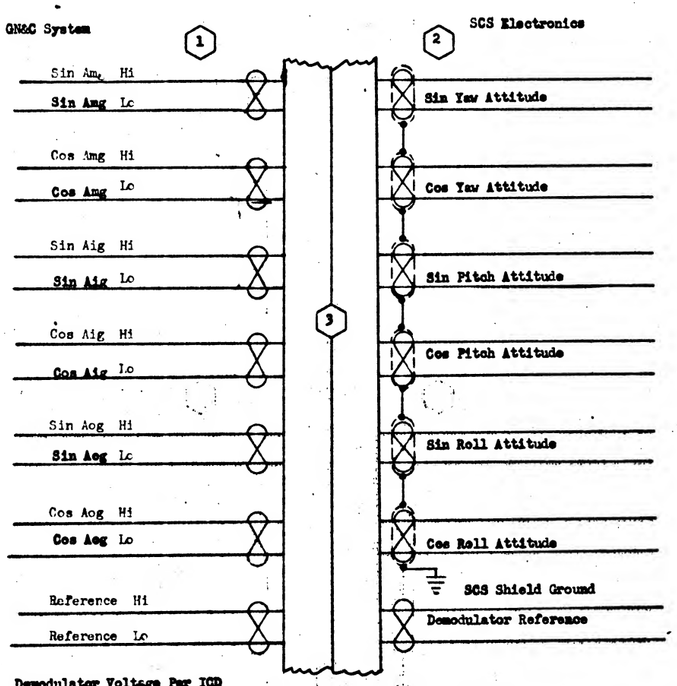


FIGURE #3

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01325-216

SHEET 9

REVISIONS A 31846

GENERAL NOTES:

(NOTE: UNLESS OTHERWISE SPECIFIED)

1. NORTH AMERICAN AVIATION INC.
   SPACE AND INFORMATION SYSTEMS DIVISION
   DOWNEY, CALIFORNIA
2. MASSACHUSETTS INSTITUTE OF TECHNOLOGY
   CAMBRIDGE, MASSACHUSETTS
3. FOR MOUNTING DETAILS SEE ICD NO. MH01-01377-100
4. THE DEUTSCH CO.
   BANNING, CALIFORNIA
5. THE BENDIX CORP.
   SCINTILLA DIVISION
   SIDNEY, NEW YORK
6. THE IMPEDANCE BETWEEN CORRESPONDING PINS OF P2 and P6 SHALL NOT EXCEED 4.0 OHMS
7. THE IMPEDANCE BETWEEN CORRESPONDING PINS OF P2 and P6 SHALL NOT EXCEED 0.8 OHMS
8. THE IMPEDANCE BETWEEN CORRESPONDING PINS OF P2 and P6 SHALL NOT EXCEED 0.4 OHMS
9. CABLE LENGTH TO BE DETERMINED BY THE NAA FACILITY
10. REFERENCE NAA DRAWING G16-850063

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01335-200

SHEET 2 OF 15

REVISIONS A 31846

E.O. 512110

APPROVALS

AUTHORIZED SIGNATURES	REPRESENTING	DATE
W.L. WHEELER	NAA	7-15-65
D. G. HOAG/STAMERIS	MIT	7-15-65

INTERFACE CONTROL DOCUMENT

DR BY	Cumming	7-14-5
CHK BY		

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

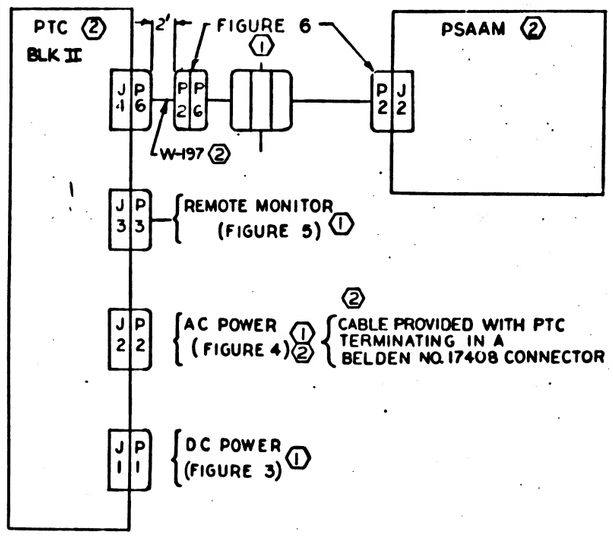
ELECTRICAL - INERTIAL COMPONENTS
TEMPERATURE CONTROLLER -
MIT/NAA/NASA

CODE IDENT NO.	SIZE	
03953	A	MH01-01335-200

SHEET 1 OF 15

Form H 110-8-57 Rev 4-63

REVISIONS A 31846



BK I K.S.C. FACILITY

FIGURE 1

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01335-200

SHEET 4 OF 15

REVISIONS 31846

SYM	DESCRIPTION	REQD	REP	DATE	APPROVED
A	1. REDRAWN WITH REVISIONS - A SIZE WAS D SIZE C40 31846		NAA MIT	19 May 66	

INTERFACE CONTROL DOCUMENT

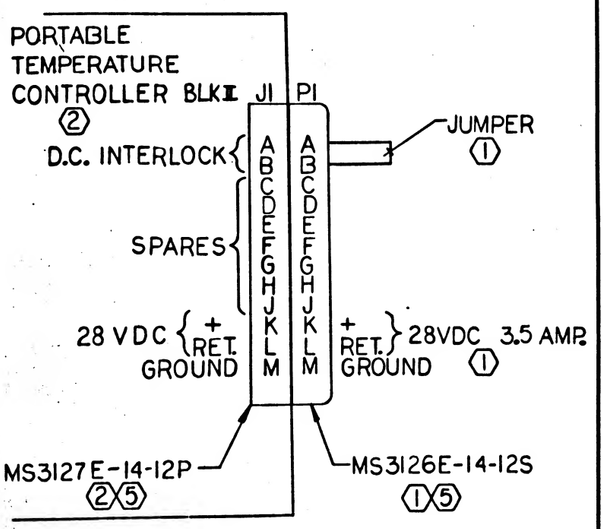
THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01335-200

SHEET 3 OF 15

REVISIONS A 31846

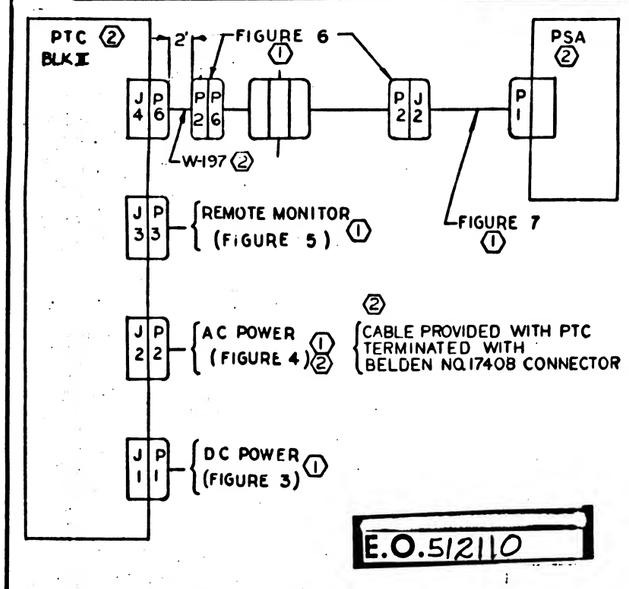


D.C. POWER

FIGURE 3

INTERFACE CONTROL DOCUMENT			
THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED	NORTH AMERICAN AVIATION, INC. SPACE and INFORMATION SYSTEMS DIVISION 12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA		
	CODE IDENT NO. 03953	SIZE A	MH01-01335-200
			SHEET 6 OF 15

REVISIONS A 31846



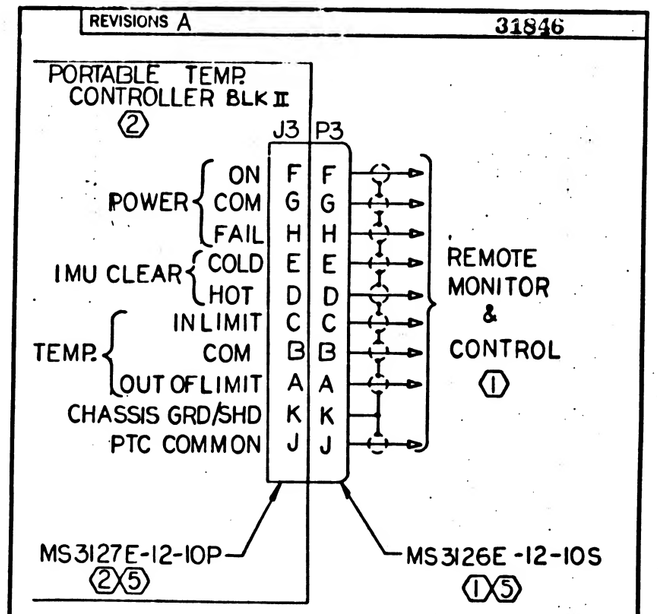
E.O. 512110

BK II ALL FACILITIES

FIGURE 2

INTERFACE CONTROL DOCUMENT			
THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED	NORTH AMERICAN AVIATION, INC. SPACE and INFORMATION SYSTEMS DIVISION 12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA		
	CODE IDENT NO. 03953	SIZE A	MH01-01335-200
			SHEET 5 OF 15

REVISIONS A 31846

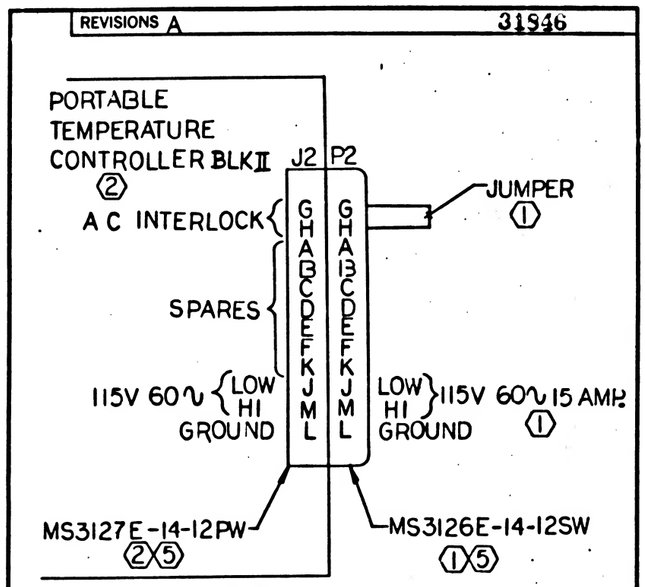


REMOTE MONITOR

FIGURE 5

INTERFACE CONTROL DOCUMENT			
THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED	NORTH AMERICAN AVIATION, INC. SPACE and INFORMATION SYSTEMS DIVISION 12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA		
	CODE IDENT NO. 03953	SIZE A	MH01-01335-200
			SHEET 8 OF 15

REVISIONS A 31846

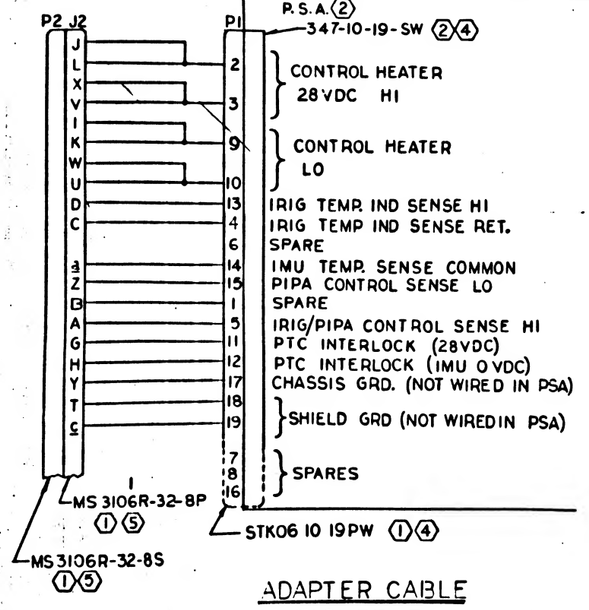


AC POWER

FIGURE 4

INTERFACE CONTROL DOCUMENT			
THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED	NORTH AMERICAN AVIATION, INC. SPACE and INFORMATION SYSTEMS DIVISION 12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA		
	CODE IDENT NO. 03953	SIZE A	MH01-01335-200
			SHEET 7 OF 15

REVISIONS A 31846



ADAPTER CAIBLE
FIGURE 7

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03963	A	MH01-01335-200

SHEET 10 OF 15

REVISIONS A 31846

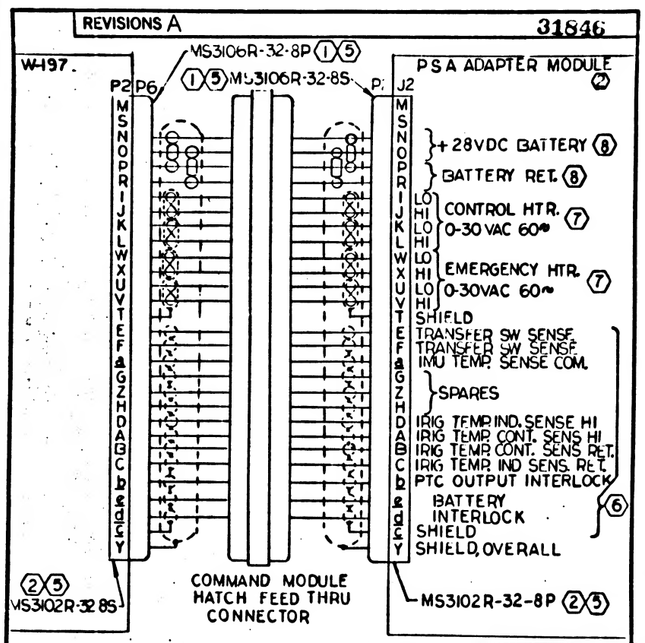


FIGURE-6

E.O.512110

INTERFACE CONTROL DOCUMENT

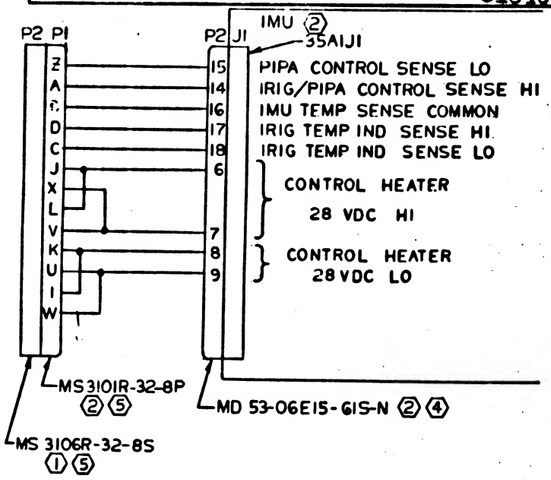
THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03963	A	MH01-01335-200

SHEET 9 OF 15

REVISIONS A 31846



IMU BLOCK II INSTALLATION CABLE
FIGURE 9

INTERFACE CONTROL DOCUMENT

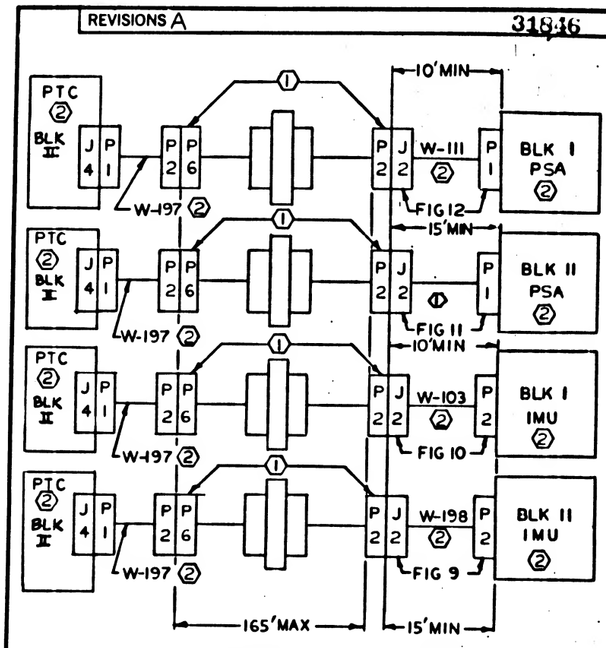
THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03963	A	MH01-01335-200

SHEET 12 OF 15

REVISIONS A 31846



INSTALLATION CABLES
FIG 8

INTERFACE CONTROL DOCUMENT

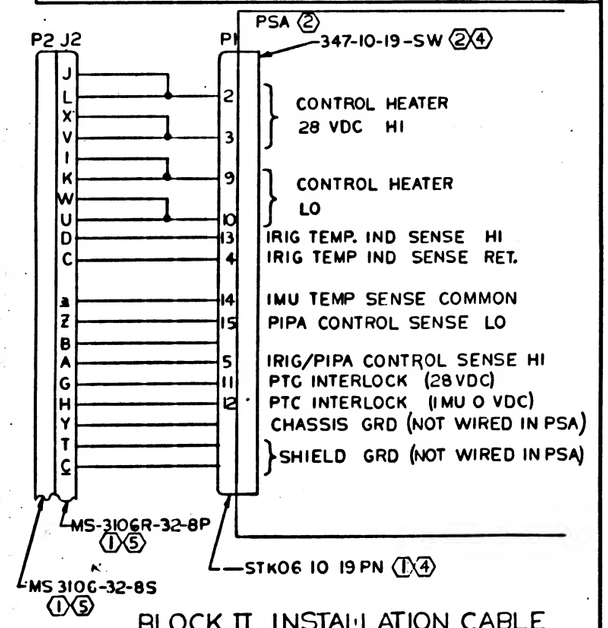
THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03963	A	MH01-01335-200

SHEET 11 OF 15

REVISIONS A 31846



BLOCK II INSTALLATION CABLE
FIGURE 11

INTERFACE CONTROL DOCUMENT

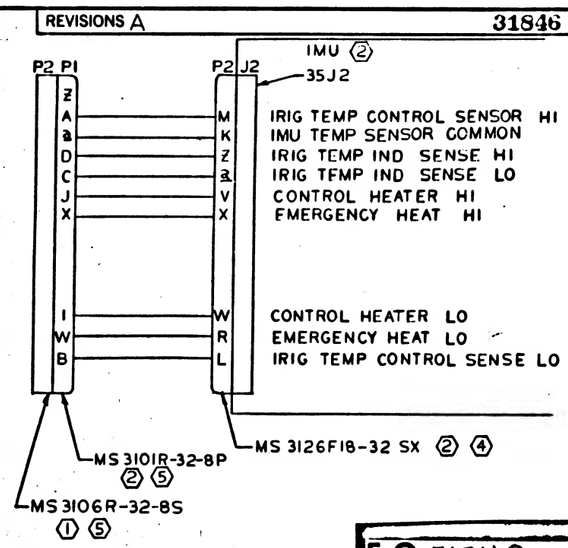
THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01335-200

SHEET 14 OF 15

REVISIONS A 31846



E.O. 512110

IMU BLOCK I INSTALLATION CABLE
FIGURE 10

INTERFACE CONTROL DOCUMENT

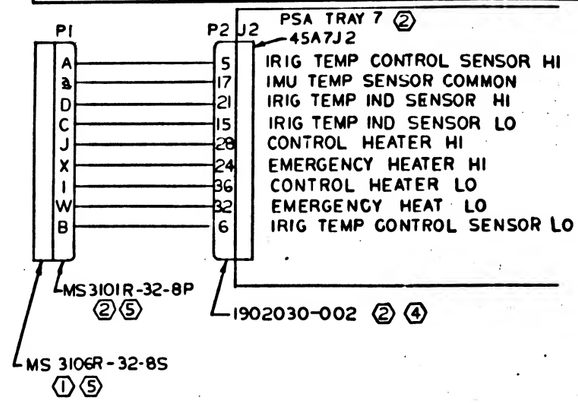
THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01335-200

SHEET 13 OF 15

REVISIONS A 31846



BLOCK I INSTALLATION CABLE
FIGURE 12

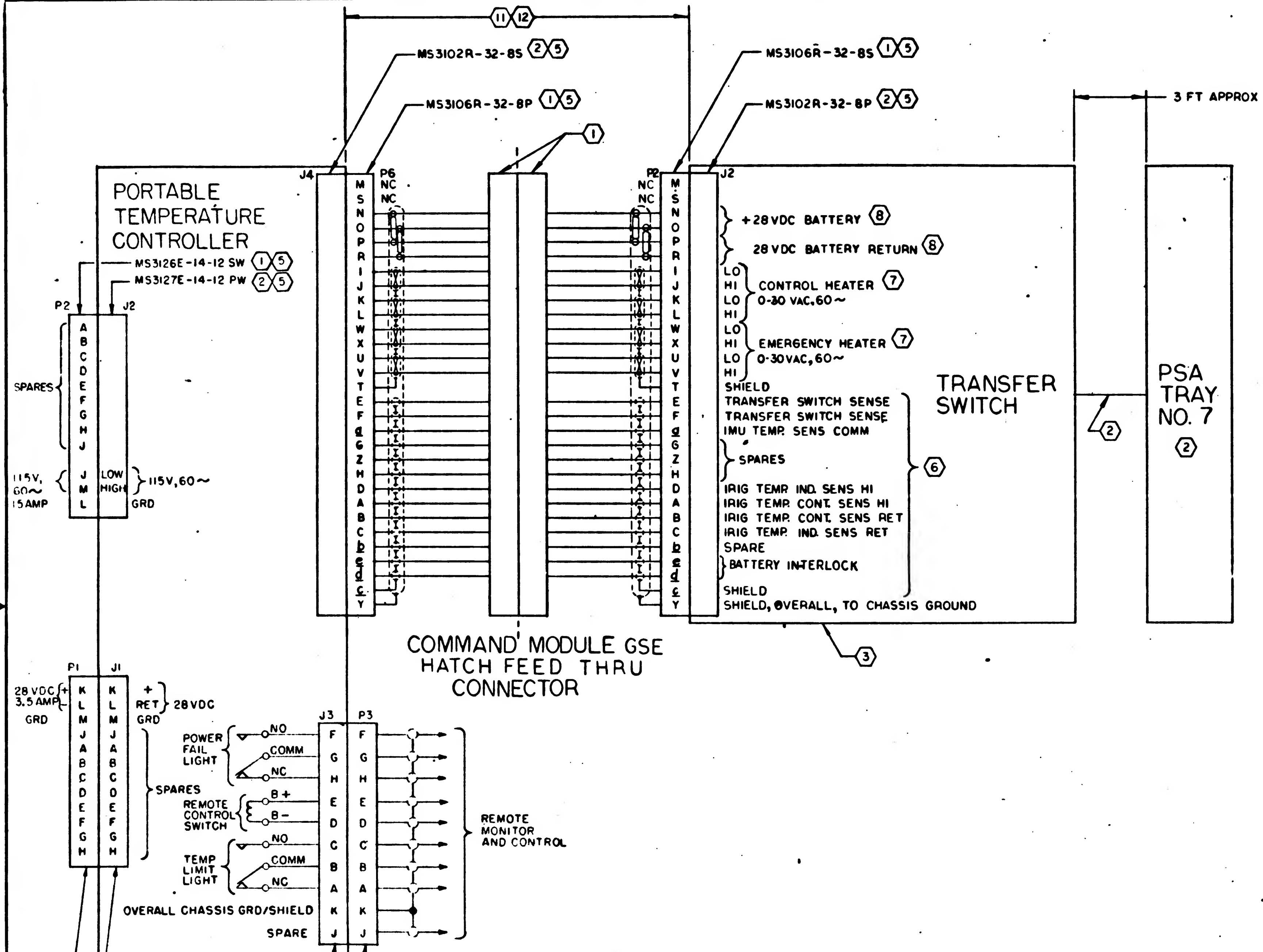
INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01335-200

SHEET 15 OF 15



MASTER

(12) 12. REFERENCE NAA DWG G16-850063
(11) 11. CABLE LENGTH TO BE DETERMINED BY THE NAA FACILITY
(10) 10. SIGMA INSTRUMENTS INC., S. BRAINTREE 85, MASS. MODEL 33R, P/N 95626; NASA P/N 1015832-218, COIL IMPEDANCE 3100 OHMS, CLOSING TIME 20 MILLISEC.
(9) 9. RELAY IS SHOWN IN SYSTEM OFF POSITION; WITH THE SYSTEM IN NORMAL OPERATION THE RELAY IS ENERGIZED AND CONNECTS J3-B TO J3-C AND J3-F TO J3-G
(8) 8. THE IMPEDANCE BETWEEN CORRESPONDING PINS OF P2 & P6 SHALL NOT EXCEED 0.4 OHMS
(7) 7. THE IMPEDANCE BETWEEN CORRESPONDING PINS OF P2 & P6 SHALL NOT EXCEED 0.8 OHMS
(6) 6. THE IMPEDANCE BETWEEN CORRESPONDING PINS OF P2 & P6 SHALL NOT EXCEED 4.0 OHMS
(5) 5. THE BENDIX CORP., SCINTILLA DIVISION, SIDNEY, NEW YORK
(4) 4. HARVEY HUBBELL INC., BRIDGEPORT, CONNECTICUT
(3) 3. FOR MOUNTING DETAILS SEE ICD NO. MH01-01377-116
(2) 2. MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MASS.
(1) 1. NORTH AMERICAN AVIATION INC., SPACE & INFORMATION SYSTEMS DIVISION, DOWNEY, CALIF.
(NOTE: UNLESS OTHERWISE SPECIFIED)

REVISIONS

SYM	DESCRIPTION	REQD BY	REP	DATE	AP
	TDRR 21398 AUG 6 1965				

MODEL NO.	PART NO.	DESCRIPTION	APPLICABLE SPECIFICATIONS

EFFECTIVITY AND SPECIFICATIONS

INTERFACE CONTROL DOCUMENT

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS .XX = ± .03 .XXX = ± .010 ANGLES ± 30'

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED.

DO NOT SCALE

DR BY	G R CUMMIN	7-14-65
CHK BY		
AUTH SIGNATURE	REP	DATE
[illegible]	NAA	[illegible]
[illegible]	MIT	[illegible]

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

ELECTRICAL-INERTIAL COMPONENT TEMPERATURE CONTROLLER -- MIT-NAA-NASA

CODE IDENT NO 03953 | SIZE D | MH01-01335-200

SCALE NONE | SHEET 1 OF 1

REVISIONS A 1-10-66

MH01-01380-216

UDR 28860 MAY 17 1968

APPROVALS

AUTHORIZED SIGNATURES	REPRESENTING	DATE
W. H. Lubs	NAA/S&ID	9-1-65
D.G. Hoag by W. Stameris	MIT	6 Oct. 65

INTERFACE CONTROL DOCUMENT

DR BY A. Silagyi

CHK BY

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

COMMAND MODULE GUIDANCE COMPUTER
ELECTRICAL INTERFACES BLOCK II
NAA-MIT

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 1 OF 65 64

REVISIONS A 1-10-66

UDR 28860 MAY 17 1968

MODEL	PART NO.	DESCRIPTION	APPLICABLE SPEC
V36-3	V36-700001	Command Module Ser. No. 98,101-112	SID64-1347,1399,1350-2

EFFECTIVITY AND SPECIFICATIONS
INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 2

REVISIONS A 1-10-66

SYM	DESCRIPTION	REQD	REP	DATE	APPROVED
A	1. Sheet 2: Added Effectivity and Specifications Information				
	2. Sheet 4: Remove Note (3)				
	3. Sheet 5: Section 10 - Changed CGC to CMC.				
	4. Sheet 8: (a) Changed CGC to CMC (b) Added Notes 1 & 2				
	5. Sheet 11: (a) Added Connector Reference Designator (b) Added Notes 1 & 2				
	6. Sheet 12: Added "Min" after Source Impedance "OFF" 0.5 Meg Ohms "MIN".				
	7. Sheet 16: Added Connector Reference Designators and notes (1) & (2)				
	8. Sheet 17: (a) Changed "Noise Susceptibility" TO: "Noise Rejection" (b) Changed "DS Open" to "ON" and Max Width 1 Millisec to "Max Width .5 Millisec. (c) Changed "DS Closed" to "OFF" and Maximum width 0.5 Millisec to "Maximum Width 1 Millisec".				
	9. Sheet 20: Added Connector Reference Designator and Notes (1) & (2).				
	10. Sheet 21: 3g Added "Spurious Pulses will not exceed one (1) per 100 second period" after last sentence.				
	11. Sheet 24: Added Reference Designators and Notes (1) & (2).				

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 3

REVISIONS A 1-10-66

SYM	DESCRIPTION	REQD	REP	DATE	APPROVED
A	12. Sheet 25: Changed "SCS Circuit".				
	13. Sheets 29, 32, 44, 54, 57, 60: Added Reference Designators and Notes 1 and 2				
	14. Sheet 45: Added Pot Taper.				
	15. Sheet 52: Change "S-IVB Cutoff" to "Injection Seq. Start".				
	16. Sheet 53: Changed S-IVB Injection Seq. Start" to "S-IVB Cutoff".				
	17. Sheet 55: Changed W4 Current from "250MA" to "500MA".				
	18. Sheet 58: Changed CGC to CMC.				
	19. Sheet 61: (a) Added "Steady State" to voltage. (b) Changed "Transients" to "Variations to S.S".				
	20. Sheet 48: (a) On Schematic, changed "Component Status and Advisory Indicators (typical 14 places)" to "Component Status and Caution Indicators (typical 14 places max. (b) Changed Current Spec. From Current: 0.180 amps per display 2.5 amps maximum drain on S/C System for Lamp Test only.				

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 3a 4

FORM NI10-N-68 NEW 4-68

REVISIONS A 1-10-66

SYM	DESCRIPTION	REQD	REP	DATE	APPROVED
A	20. Sheet 48: To Current: 0.180 amps/display (Caution Indicators) 0.225 amps/display (status Indicators) (2.5 amps max drain on S/C System for lamp test only." 21. Add Sheet 11A: CM and SM RCS Jet Configuration		NAA/S&ID	4/1/66	E Kennedy
			MIT	April 66	W. Stameris

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 5

REVISIONS A 1-10-66

NOTE: Unless Otherwise Specified:

(1) Massachusetts Institute of Technology
Instrumentation Laboratory
Cambridge, Massachusetts

(2) North American Aviation, Inc.
Space and Information Systems Division
Downey, California

ϕ

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 6

REVISIONS A 1-10-66

TABLE OF CONTENTS

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 7

REVISIONS A 1-10-66

1.0 SCOPE

This ICD defines all of the electrical interfaces that are associated with the Command Module Guidance Computer. It will specify the characteristics, wiring, and shielding of each.

There are various input and output circuits associated with the CMC. These circuits are categorized as follows:

Y, YS - Y: Input transformer circuit; YS: source for "Y" circuit.
X, XR - X: Output transformer circuit; XR: receiver of "X" circuit.
D, DS - D: DC input circuitry; DS: source for the "D" circuit.
C, CR - C: DC output circuit; CR: receiver for "C" circuit.
S, SR - S: Switch closure; SR switch closure receiver.
W, WR - W: Just a wire connection; WR: receiver for "W".
R - R: DC power source.

The numbers following any particular designation (C2, X2, CR2, XR2, etc.) together with the section numbers uniquely designates a particular CMC output circuit or input circuit.

1.1 Grounding Symbology

The following drawing symbology shall be used throughout this ICD:

a) AC Grounds
   1. AC Power
   2. AC Signal

b) DC Ground
   1. DC Power
   2. DC Signal Ground

c) Isolated Circuit Ground

d) Structure Ground

e) Vehicle Ground Point

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 8

2.0 Waveform and Noise Measurement Techniques

1. Pulse Measurements

   a. Measurements to be made at points indicated in appropriate sections of this ICD.

   b. Measurements to be made with Tektronix 540 series, type 1A1 differential preamp, 10/1 attenuator probes; or equivalent. Scope to be grounded at GMC only, if at all.

2. Noise Measurements

   a. Measurements to be made with Tektronix 540 series, type CA preamp, and P6016 current probe and type 131 amplifier; or equivalent.

   b. The current to voltage conversion factor will be the load pulse impedance (200 ohms; XR, Y) or DC impedance (22K ohms; CR, D) where applicable.

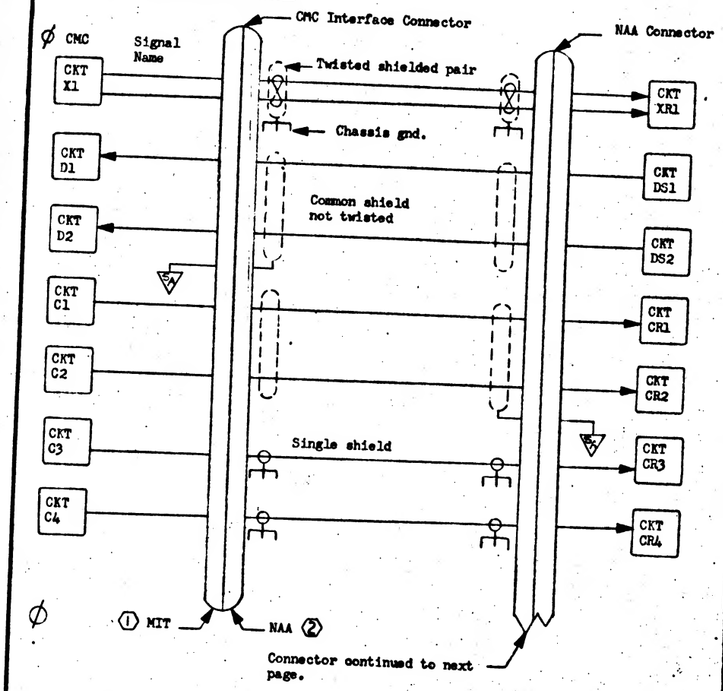
3. AC Measurements

   a. Hewlett-Packard 400D or equivalent.

4. DC Measurements

   a. Scope or equivalent.

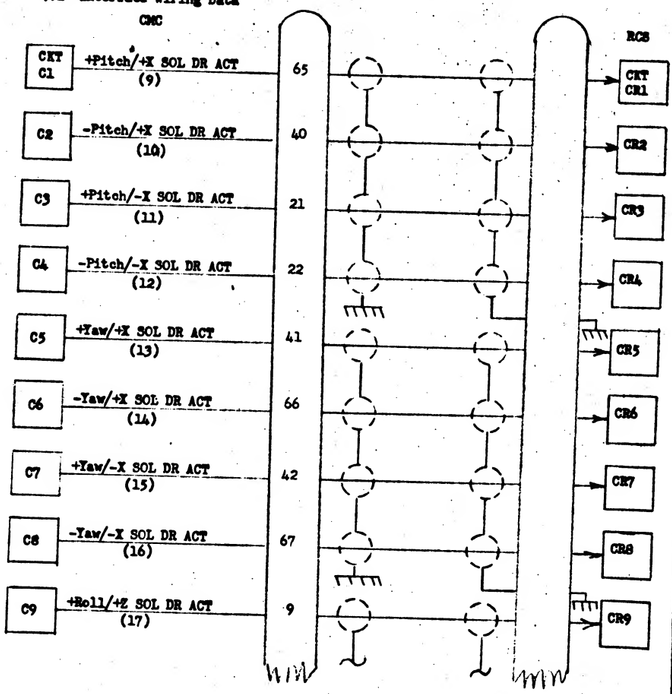
3.0 DEFINITION OF SYMBOLS



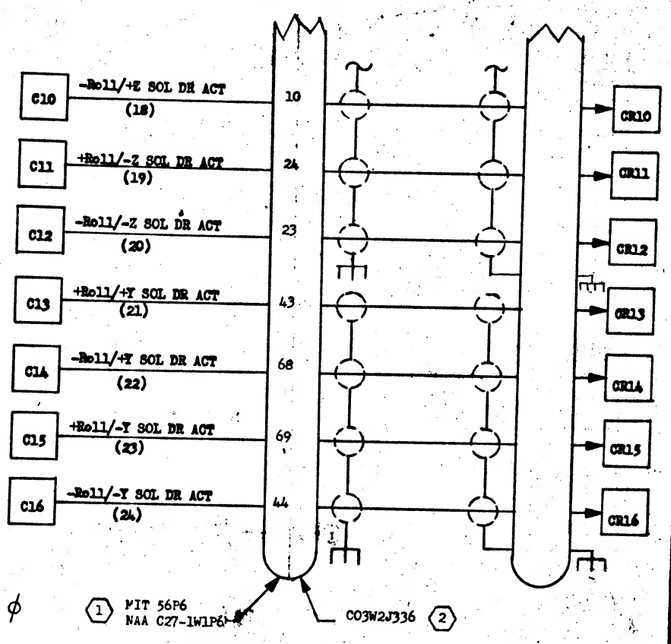
4.0 CMC to RCS Drivers

This section describes the interface between the Apollo Guidance Computer and the SCS Reaction Control System. The Apollo Guidance Computer will provide output-discretes to SCS reaction jet drivers to command reaction jet firing. There will be a total of 16 output lines provided, each line carrying the ignition command for one of the 16 S/M reaction jets for commanding vehicle rotation and translation or one of the 12 C/M reaction jets for commanding vehicle rotation only. The remaining four lines have no function after the SM is detached. The presence of high voltage on a line as referenced to spacecraft ground will indicate a jet OFF discrete.

4.1 Interface Wiring Data

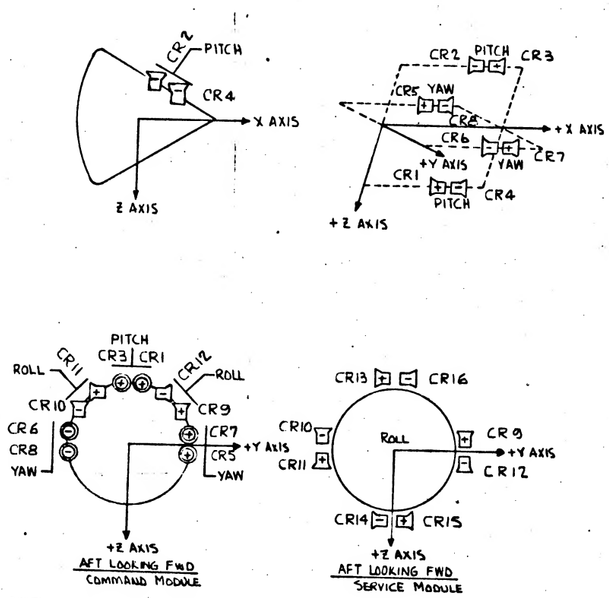


4.1 Interface Wiring Data (Continued)



4.1 Interface Wiring Data (Cont.)

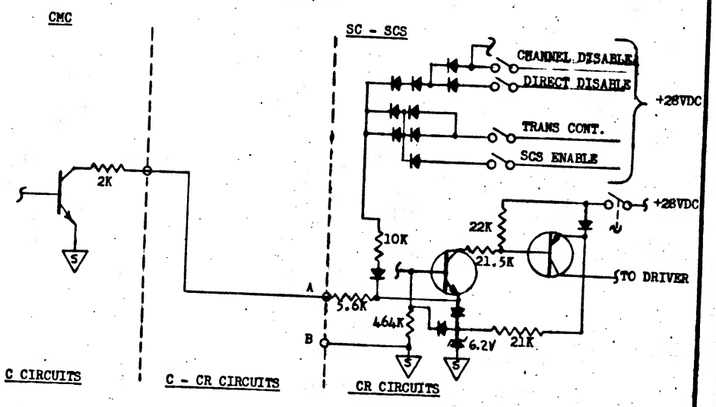
CM AND SM RCS JET CONFIGURATION



NOTE: CR 13, CR 14, CR 15, CR 16 are Not Used After CM/SM Separation

SCHEMATIC FOR REFERENCE ONLY

4.2 Circuit and Signal Characteristics



All Measurements Made from A to B, B Ref.

Amplitude: "ON" 5VDC ± 5 VDC
"OFF" 28VDC ± 5 VDC

Circuits: C1-C16 Shown Above
CR1-CR16 Shown Above

Current: "ON" 5 MA Max.

Source Impedance: "ON" 3K Max to CMC Gnd, 0-5 MA Range
"OFF" 0.5 Meg Ohms Min. 0-40 Volt Range

Source Rise Time: Less then 1 μ sec.

Noise Rejection: "ON" +6OV Noise pulse, max width 0.5 millisec, maximum rep rate 10 pps
"OFF" -20V Noise pulse, max width 1 millisec, maximum rep rate 10 pps

NOTE: SCHEMATICS SHOWN FOR REFERENCE ONLY

5.0 CONTROL MODE AND STATUS SIGNALS

5.1 Signal Definitions

5.1.1 LEM Attached (△ V CG, LEM/CSM - CSM)

The LEM Attached signal will be a switch closure on the Command Module Main Display Panel. This switch closure will be pilot initiated upon completion of LEM transposition and docking.

5.1.2 SPS Ready (△ V Thrust, Normal - Off - Direct On)

The SPS Ready signal will be provided by a switch closure on the Command Module Main Display Panel. This switch closure will be pilot initiated and will indicate procedurally the completion of the pre Delta V checkout procedure. The SPS engine cannot be fired unless this discrete is present.

5.1.3 Attitude Hold (SC Control, CMC, Auto - Hold - Free)

The Attitude Hold signal will be a switch closure on the Command Module Main Display Panel. This switch will be pilot initiated at such time, during primary control, as it is desired to hold the present attitude of the spacecraft.

5.1.4 Free Drift (SC Control, CMC, Auto - Hold - Free)

The Free Drift signal will be a switch closure on the Command Module Main Display Panel. This switch will be pilot initiated at such time, during primary control, as it is desired to inhibit automatic control and permit manual control of the spacecraft through the CMC (hand controllers, minimum impulse).

5.1.5 Accept Uplink (UPTLM, Accept - Block)

The Accept Uplink signal will be a switch closure on the Command Module Main Display Panel. This switch will be pilot initiated at such time as it is desired to receive information via the update link. A similar switch shall be provided in the LEM. Both switches must be in accept position to receive uplink data.

5.1.6 C/M - S/M Separate

The Service Module Separation signal will be a parallel contact closure within the SM/CM Reaction Jet Control Transfer unit. This contact closure indicates initiation of SM separation. The contact closure occurs 110 milliseconds prior to physical separation of CM/SM. The

switch transfer time is 100 milliseconds maximum.

5.1.7 SIV-B Separate

The S-IVB Booster Separation Signal will be a contact closure within the Spacecraft Master Events, Sequence Controller. This contact closure indicates S-IVB booster separation and shall occur simultaneously with the firing of the Service Module, LEM Adapter (SLA) separation Pyres.

5.1.8 Lift Off

The "Lift Off" signal will be a switch closure in the S-IVB Instrumentation Unit. The signal indicates that the IU umbilical has been removed and that the vehicle is in the lift-off phase.

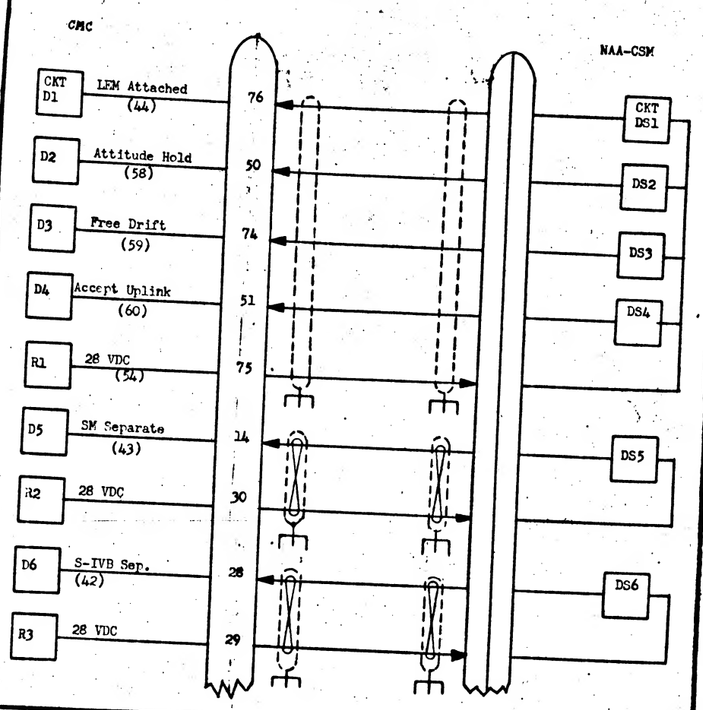
5.1.9 Guidance Reference Release

The Guidance Release signal will be a switch closure in the S-IVB Instrumentation Unit. This signal will indicate that the Saturn IU external pre-launch alignment control has been removed and the IU is inertially stabilized.

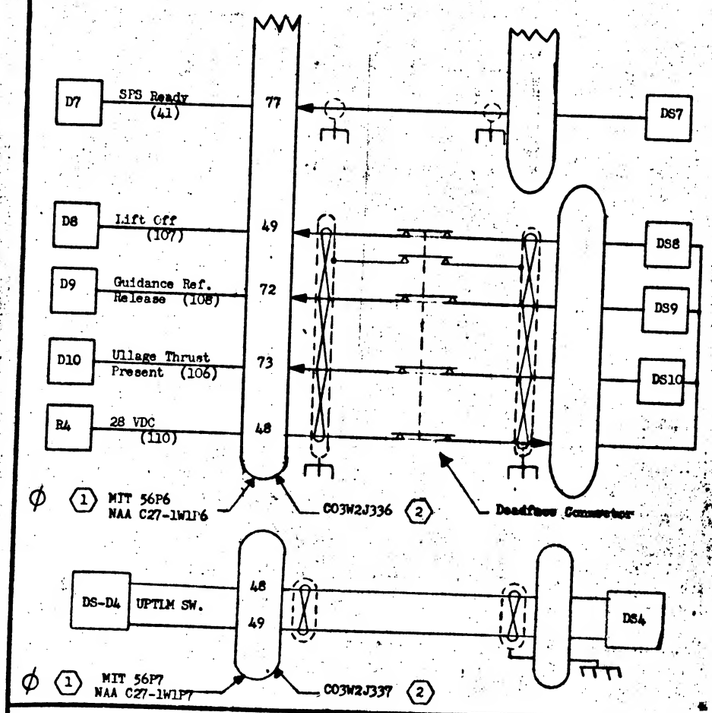
5.1.10 Ullage Thrust Present

The Thrust Moniter signal shall be a switch closure in the S-IVB Instrument Unit. The signal shall indicate the presence of thrust on the S-IVB due to ullage.

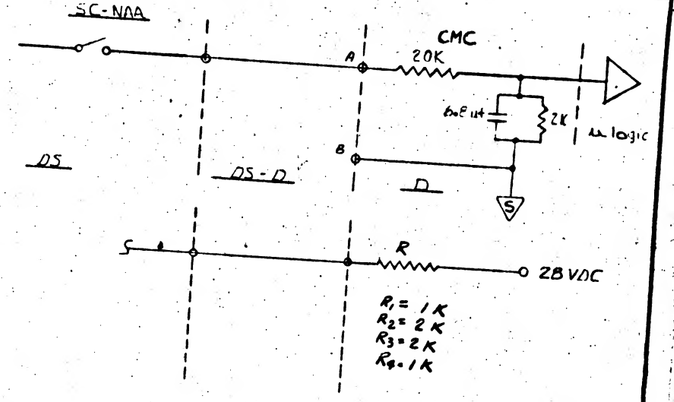
5.2 Interface Wiring Data



5.2 Interface Wiring Data (Cont.)



5.3 Circuit and Signal Definition



All Measurements Between Points A, B, B Reference

Amplitude "1" 28 ± 11 VDC
Amplitude "0" 0 ± 2 VDC

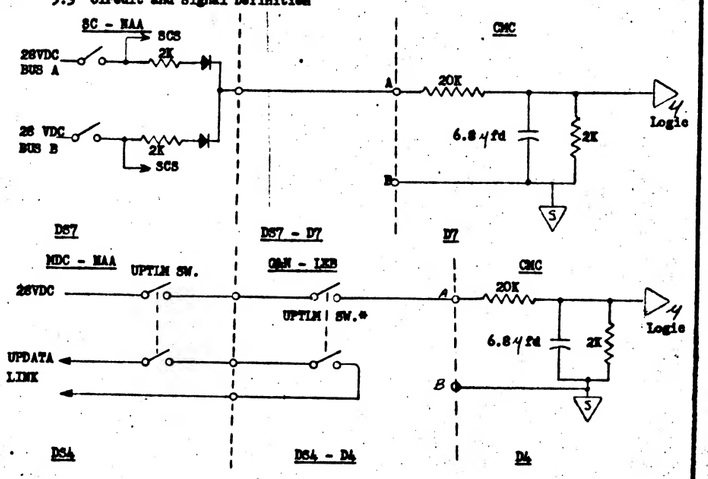
Noise Rejection:

"ON": +80V Noise Pulse, Max Width .5 Millisecond, maximum Rep. Rate 10 pps
"OFF": -20V Noise Pulse, Max Width 1.0 Millisecond, maximum Rep. rate 10 pps

Circuits

D1, 2, 3, 5, 6, 8, 9, 10
DS1, 2, 3, 5, 6, 8, 9, 10 As Shown Above
R1 - R4

5.3 Circuit and Signal Definition



All Measurements Between Points A, B, B Reference

Amplitude "1" 28 ± 11 VDC
Amplitude "0" 0 ± 2 VDC

Noise Rejection:

"ON": +60V Noise Pulse, Max Width .5 Millisec, maximum Rep. Rate 10 pps
"OFF": -20V Noise Pulse, Max Width 2.0 Millisec, maximum Rep. Rate 10 pps

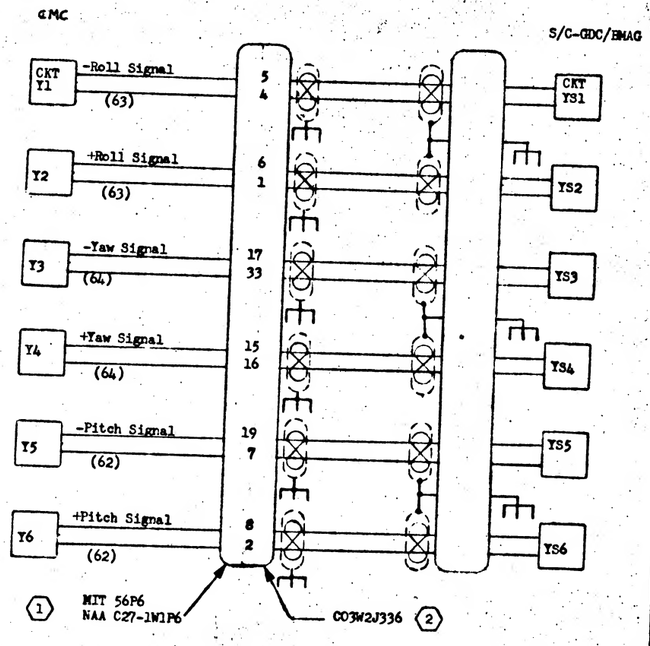
*Note: Contact rating of "UPTLM SW.": 28 VDC, 0.5 Amps

Circuits: D4, D7 As Shown Above
DS4, DS7

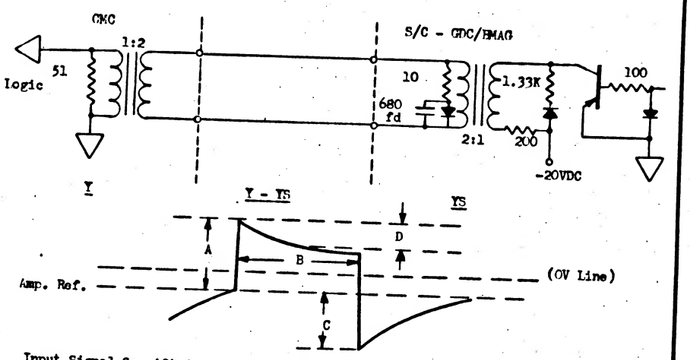
6.0 ATTITUDE SIGNALS FROM GYRO DISPLAY COUPLER (GDC)

This section describes the interface between the CMC and GDC's in the SCS system. The GDC's, driven from the RMAG's, shall provide attitude information to the G&N CMC. The signals shall be in digital form transmitted as two wire signals isolated from ground in both the SCS and CMC. The interface shall consist of six signals (two wires per polarity per axis).

6.1 Interface Wiring Data



6.2 Circuit and Signal Characteristics



Input Signal Specified at G&N Interface

1. Load Impedance: 200 ± 10% ohms
2. Source Impedance: 100 ohms maximum
3. Signal Characteristics:
   a. Signal Amplitude: (A) 7 ± 3 volts
   b. Pulse Width: (B) 2-6 μ sec (@A/2 point)
   c. Backswing: (C) 4V maximum
   d. Droop: (D) 20% at 2 μ sec point
   e. Rise Time: (10-90% of A) 0.5 μ sec maximum
   f. Zero Volt: The zero volt line is defined as the mean value of the waveform.
   g. Delta Angle: Each pulse oppearing on the line shall represent 0.1 ± .8% degrees. The maximum PRR is 640 pps.
   h. Null Offset Effects: Less than one (1) pulse per 100 seconds output with equal to or greater than zero rate input to the gyro assembly.

ϕ

NOTE: SCHEMATIC FOR REFERENCE ONLY

6.2 (Continued)

h. Noise Specification

1. Noise during the transmission of the pulse: The signal plus noise shall remain within the envelope of amplitude defined above (A,B).

2. Noise during the absence of the pulse: +0.4 volts max, -4.0 volts max; measured with respect to the amplitude reference (See Figure).

i. Presence of the pulse shall indicate "ON" condition. Absence of pulse shall indicate "OFF" condition.

Circuits

Y1 - Y6 Shown above, CMC Transformer: NASA Drawing 1006319

YS1 - YS6 Shown above

7.0 MAIN ENGINE AND SATURN ENGINE CONTROL SIGNALS

This section describes the interface between the CMC and the SPS Drivers. The CMC provides an output-discrete signal to the SPS solenoid driver circuitry to command SPS firing. One line will be provided for this command. The presence of voltage on this line as referenced to spacecraft ground shall command main engine OFF.

In addition, the CMC will provide two signals to the S-IVB Instrument Unit. These signals are:

1. S-IVB Engine Fire Cycle

This signal will initiate the S-IVB engine firing sequence for translunar injection. The signal shall be a switch closure in the MDP-DSKY causing a 28 VDC signal to be sent to the Saturn Instrument Unit.

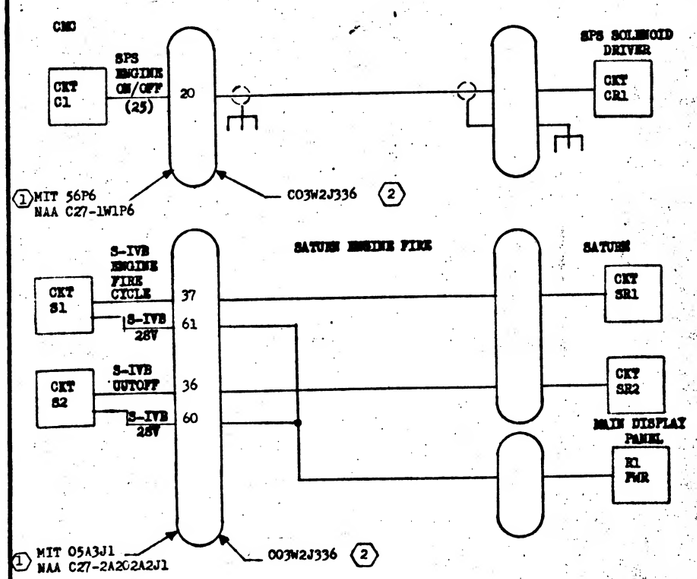
2. S-IVB Cutoff

This signal commands the termination of main engine thrusting. This signal will be initiated by a switch closure in the MDP-DSKY and will send Saturn 28 VDC power back to the Saturn IU.

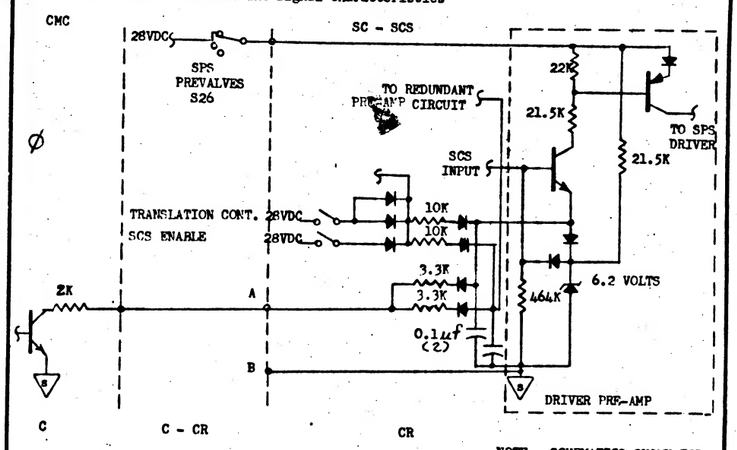
The 28 VDC power for the above Saturn signals shall be routed from the Saturn Instrument Unit through the Saturn control switch to the DSKY relays on the Main Display Panel.

7.1 Interface Wiring Data

MAIN ENGINE SIGNALS



7.2 Interface Circuit and Signal Characteristics



NOTE: SCHEMATICS SHOWN FOR REFERENCE ONLY

All Measurements Made from A to B, B Ref.

Amplitude: "ON" 5V + 5V
"OFF" 28V ± 5V

Circuits: C1 and CR1

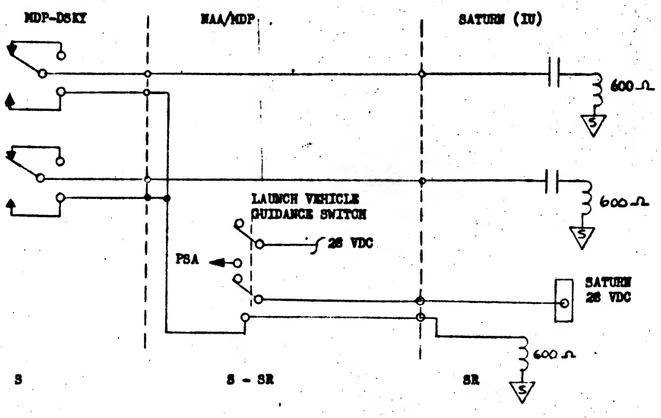
Current: ON 5 MA Maximum

Source Impedance: "ON" 3K Max to CMC Ground, 0-5MA Range
"OFF" 0.5 Meg Ohms, 0-40 Volt Range

Source Rise Time: Less than 1 μ sec.

Noise Rejection: "ON" +80V Noise Pulse, Max Width 0.5 Millisec, Maximum Rep. Rate 10 pps
"OFF" -20V Noise Pulse, Max Width 1 Millisec, Maximum Rep. Rate 10 PPS

7.2 Continued



Circuits:

NOTE: SCHEMATICS SHOWN FOR REFERENCE ONLY

S Circuit

Voltage: 28 ± 4 VDC

Current: 0.5 amps Maximum

Switch Shown in OFF Position

S-SR Circuits (Refer to ICD MH01-01344-216 for additional details)

Voltage: 28 ± 4 VDC

Current: 0.5 amps Maximum

SR Circuits

Voltage: 28 VDC Current: 50 Milliamps

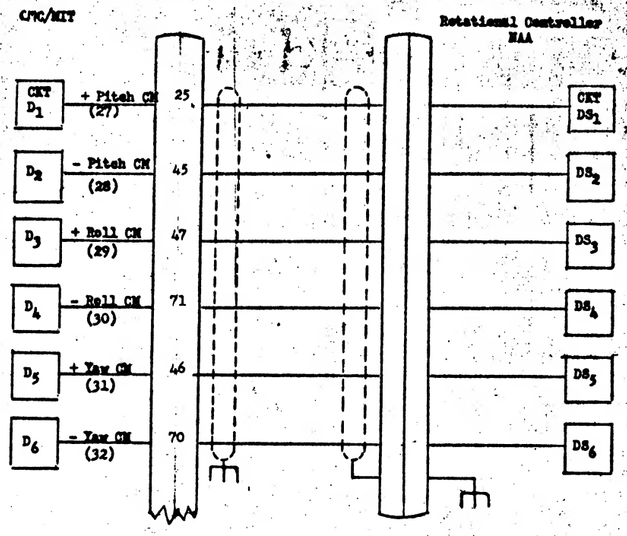
8.0 Rotational and Translational Controller Signals

8.0.1 Rotational Hand Controller - The SCS shall provide discrete D-C output signals through the rotational hand controllers to the CMC whenever the controller is activated mechanically by astronaut motion. There shall be six lines representing commands of positive and negative rotation in all three axes from the two controllers.

8.0.2 Translational Hand Controller - The SCS shall provide discrete d-c output signals through the rotation control to the CMC whenever the controller is activated mechanically by astronaut motion. There shall be six lines representing commands of positive and negative translation in all three axes.

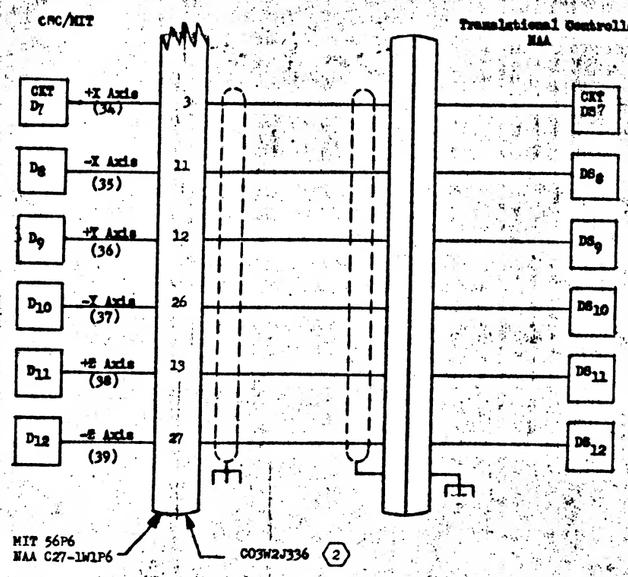
8.1 Interface Wiring Data

ROTATIONAL CONTROLLER

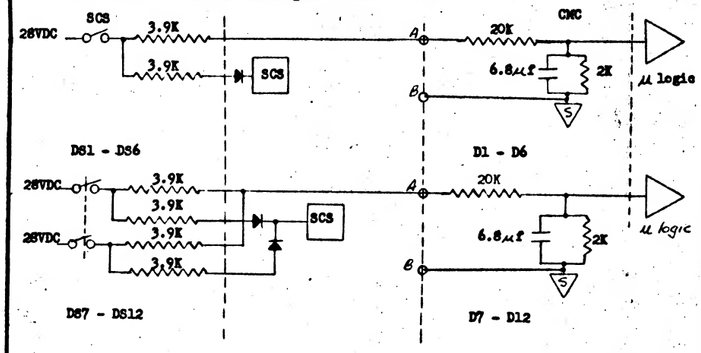


8.1 Interface Wiring Data (Continued)

TRANSLATIONAL COMMANDS



8.2 Interface Circuit and Signal Characteristics



All measurements made from Points A to B, B Ref.

NOTE: SCHEMATIC FOR REFERENCE ONLY

Signal Characteristics:

a. "ON" Signal

(1) Voltage: 28 + 11 VDC
(2) Current: 0.01 Amps
(3) Source Impedance: 3.9K Ohms Nominal - Rotation Control
1.95 Ohms Nominal - Translation Control

b. "OFF" Signal

(1) Voltage: +2, -5 VDC
(2) Source Impedance: 0 K (Minimum)

c. Noise Rejection

(1) "ON" Signal: +80 V noise pulse, maximum width .5 millisec maximum rep rate 10 pps
(2) "OFF" Signal: -20 V noise pulse, maximum width 0.0 millisec maximum rep rate 10 pps

Circuits

D1 - D12 As shown
DS1 - DS12 As shown

9.0 MASTER CLOCK AND TELEMETRY

9.0.1 Master Clock

The C&N System shall provide a synchronizing pulse from the CMC, This timing pulse will be used to synchronize the NAA Central Timing Equipment with the Computer.

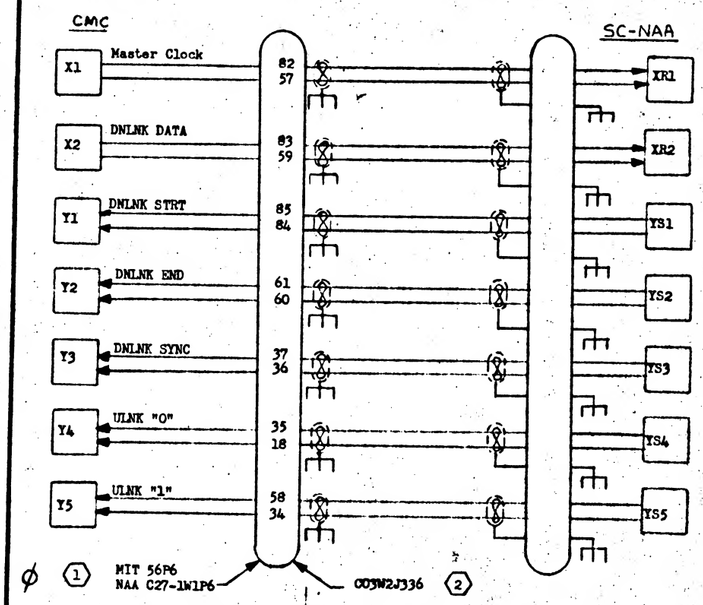
9.0.2 Telemetry

There will be two interfaces with PCM equipment:

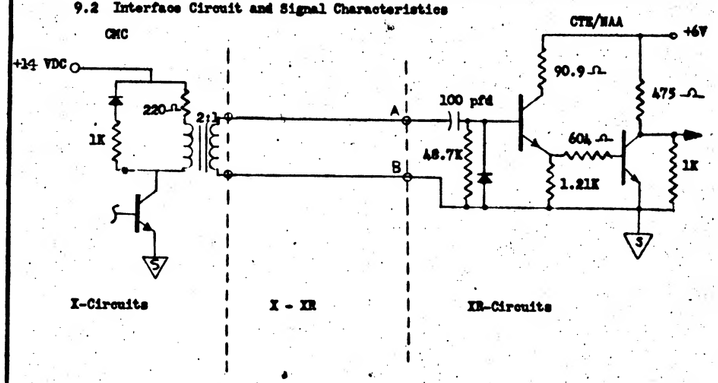
1. Downlink - The Downlink shall consist of eight lines, two each for Downlink data, Downlink start, Downlink end, and Downlink sync. This link shall be used to transmit data to the ground via telemetry.

2. Uplink - The uplink will consist of four lines, two each for Uplink "0" and Uplink "1". This link shall be used to transmit data from the ground via Up-Data Link.

9.1 Interface Wiring Data



9.2 Interface Circuit and Signal Characteristics



NOTE: Schematics Shown for Reference Only

All Measurements Made from A to B, B Ref.

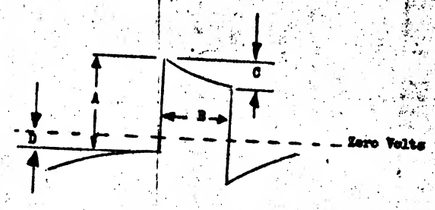
1. Load Impedance - 500 ohms (approximate)

2. Source Impedance:

a. Impedance during pulse - 100 ohms (approx)
b. Resistance of Winding - 10 ohms maximum
c. Inductance of winding - 10 mh (maximum)

9.2 Continued

3. Signal Characteristics at CMC Interface
(Test Load of 510 ohms)



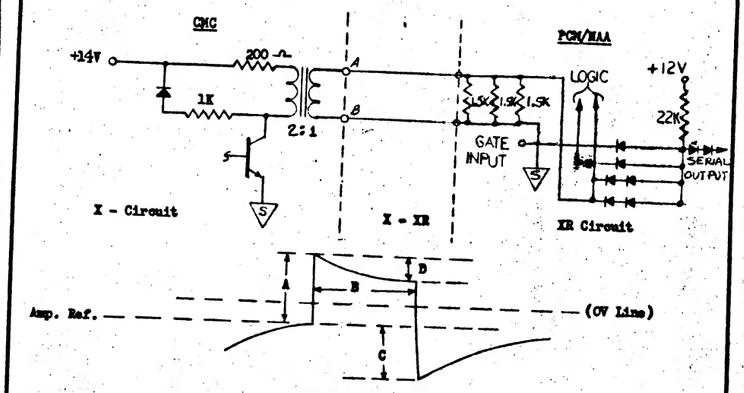
a) Amplitude (A) = 4 to 14 volts
b) Pulse width (B) 40.5 ± 0.25 μ sec.
c) Zero Shift (D) = 50% of A (Approx.)
d) Rise time (10% to 90% of A) = 0.2 μ sec. max.
e) Noise and ripple - 0.2 volts max.
f) Frequency - 1024 KC ± 2 PPM
g) Zero volt line is defined as the mean value of the waveform.
h) Grounding: The master clock output signal and shall be ... ground isolated in the G&N System.
i) Presence of pulse shall indicate "ON" condition.
Absence of pulse shall indicate "OFF" condition.

Circuits

X1 Shown above, CMC Transformer: NASA Drawing No. [redacted]

XR1 Shown Above

9.2 Continued



Interface Signal Specified at G&N Interface

1. Load Impedance: 500 ± 10% ohms nominal, note XR circuit above.
2. Source Impedance: 100 ohms maximum, note X circuit above.
3. Signal characteristics at the G&N Interface
(Test load of 510 ohms ± 10% acceptable)
   a. Amplitude (A) 7 ± 3V
   b. Pulse Width (B) 2.5 to 6 μ sec. at A/2 Point
   c. Backswing (C) 6V maximum
   d. Droop (D) 15% of "A" maximum at 2 μ sec. maximum

NOTE: SCHEMATICS SHOWN FOR REFERENCE ONLY

9.2 Continued

e. Rise Time (10-90% of A) 0.2 μ sec maximum

f. Zero Volt: The zero volt line is defined as the mean value of the waveform and is determined by the pulse shape and repetition rate.

g. Noise Specification

1. Noise during the transmission of the pulse:
The signal plus noise shall remain with the envelope of amplitude defined above (A,B).

2. Noise during the absence of the pulse:
+0.4 volts max, -4.0 volts max; measured with respect to the amplitude reference (see Figure).

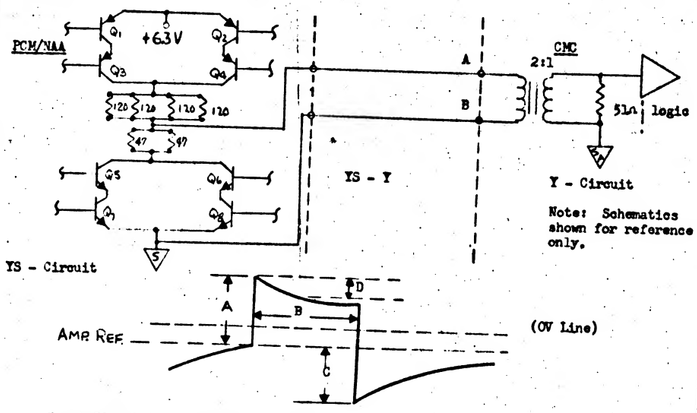
h. Presence of the pulse shall indicate "ON" condition.
Absence of pulse shall indicate "OFF" condition.

Circuits

X2 shown above, CMC transformer: NASA Drawing No. 1006319

XR2 to be furnished, NAA

9.2 Continued



Note: Schematics shown for reference only.

Input Signal Specifications at G/N Interface

1. Load impedance: 200 ohms nominal, note Y circuit above.
2. Source Impedance: 100 ohms max.
3. Signal characteristics at G/N interface
(Test load of 200 ohms ± 10% acceptable)
   a. Amplitude (A) 4.5 ± 1V
   b. Pulse Width (B) 4.5 ± 1.5μ sec (at A/2 point)
   c. Droop (D) 15 % of "A" at 2μ sec max
   d. Rise Time (10-90% of A) 0.2μ sec max
   e. Zero Volt: The zero volt line is defined as the mean value of the waveform and is determined by the pulse shape and repetition rate.

9.2 Continued

g. Noise Specification

1. Noise during the transmission of the pulse:
The signal plus noise shall remain within the envelope of amplitude defined above (A,B).

2. Noise during the absence of the pulse:
+0.4 volts max, -4.0 volts max; measured with respect to the amplitude reference (see Figure).

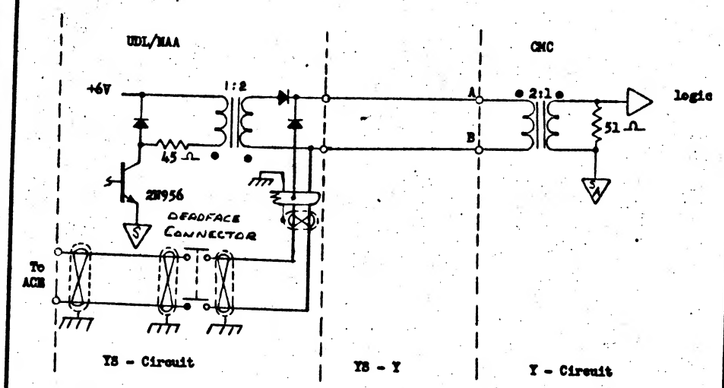
h. Presence of the pulse shall indicate "ON" condition.
Absence of pulse shall indicate "OFF" condition.

Circuits

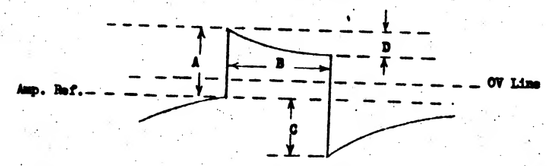
Y1 - Y3 shown above, CMC transformer: NASA Drawing No. 1006319

YS1 - YS3 to be furnished, NAA

9.2 Continued



NOTE: Schematics shown for reference only.



Input Signal Specifications at CMC Interface

1. Load Impedance: 200 ohms nominal, note Y circuit above.
2. Source Impedance: (Maximum) 220 Ω During Pulse

9.2 Continued

3. Signal Characteristics at CMC Interface
(Test load of 200 ohms ± 10% acceptable)

a. Amplitude (A) 7 ± 3V

b. Pulse Width (B) 2-6 μ sec (at A/2 point)

c. Backswing (C) 4V maximum

d. Droop (D) 20% of "A" maximum

e. Rise Time (10-90% of A) 1 μ sec maximum

f. Zero Volt: The zero volt line is defined as the mean value of the waveform and is determined by the pulse shape and repetition rate.

g. Noise Specification

1. Noise during the transmission of the pulse:

The signal plus noise shall remain within the envelope of amplitude defined above (A, B).

2. Noise During the absence of the pulse:

+0.4 volts maximum, -4.0 volts maximum; measured with respect to the amplitude reference (see Figure).

h. Presence of the pulse shall indicate "ON" condition.
Absence of the pulse shall indicate "OFF" condition.

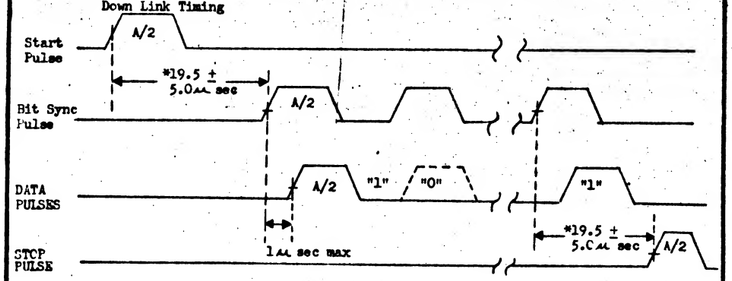
Circuits

Y4 - Y5 Shown above, CMC transformer: NASA Drawing No. 1006319

YS4 - YS5 To be furnished, NAA

9.2 Continued

Down Link Timing



a. Start pulses: Normal rate 50 pps, low rate 10 pps.

b. Bit sync pulses: Normal rate 51.2 Kpps, low rate 1.6 Kpps. There will be 40 pulses per burst.

c. Data pulses: Frequency and width determined by bit sync pulses. A "1" is the presence of a pulse and a zero as the absence of a pulse with a bit sync pulse.

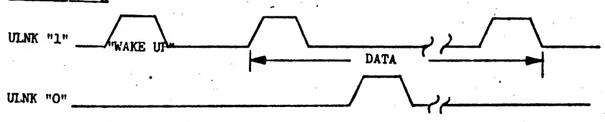
d. Stop pulses: Normal rate 50 pps, low rate 10 pps.

e. During CMC "Standby Mode", data is all "1's".

* Time shown hold for normal data rate; for low data rate replace 19.5 ± 5μ sec by 625 ± 156 μ sec.

9.2 (Continued)

Uplink Timing



a. Bit rate of O's and 1's is 1.1 Kpps maximum.

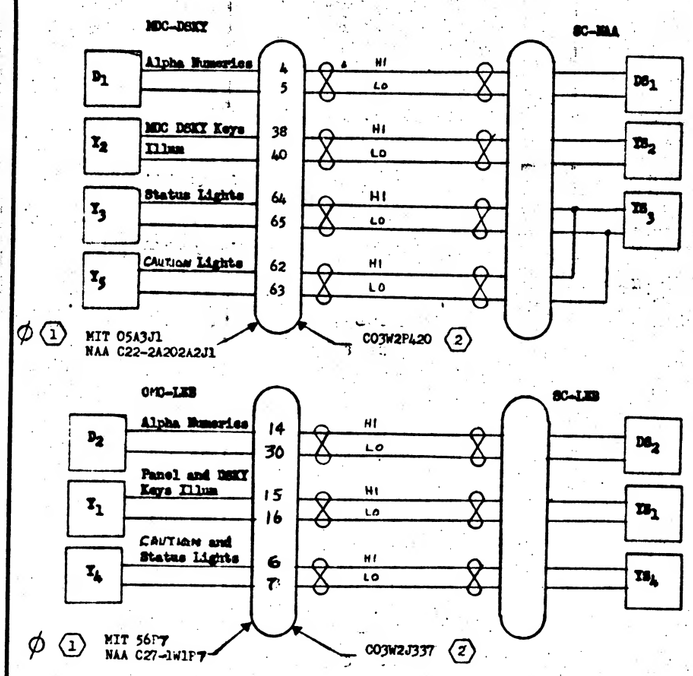
b. 1 word is composed of 16 pulses; a "wake up" bit on the "1" line followed by 15 bits on the "1" or "O" lines.

c. Minimum time between words is 0.1 seconds.

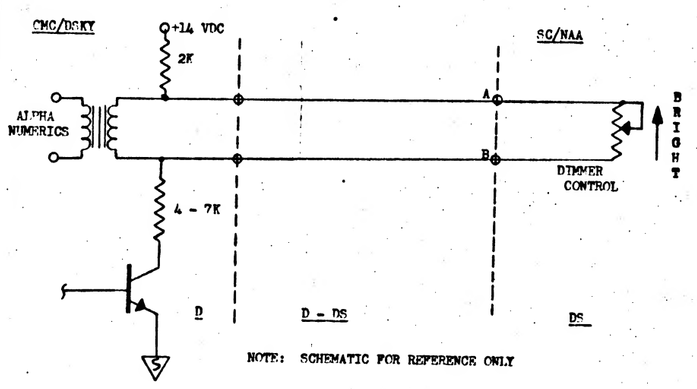
10.0 CM Computer Display Keyboard (DSKY) Illumination Power

This section covers the electrical interface for the MDC-DSKY and the LEB-DSKY Illumination. NAA will provide power and dimming controls for EL integral lighting (keys), alpha numerics, and the advisory and component status lights.

10.1 Interface Wiring Data



10.2 Circuit and Signal Characteristics



All Measurements Made from A to B, B Reference

Waveform: 800 cps Square Wave, 14 VDC maximum

Current: 2MA Maximum

Dimmer Control:

Type - 10K ± 5%

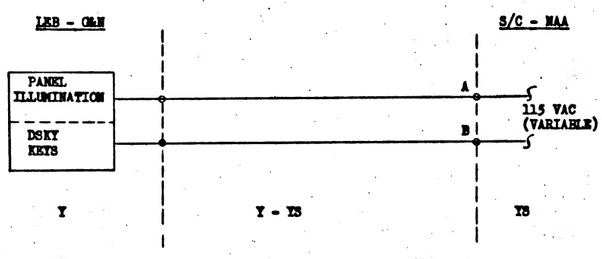
Taper - Linear

Circuirts:

D_1 and D_2

DS_1 and DS_2

10.2 Circuit and Signal Characteristics (Continued)



NOTE: SCHEMATIC FOR REFERENCE ONLY

All Measurements Made from A to B, B Reference

Voltage: 115V ± 4.3 (Controlled 0 - 115 VAC)

Current: 317.5 MA @ 75V (APPROXIMATE)

Frequency: 400 cps ± 7 cps

VA: 23.8

Watts: 10.66 MAX.

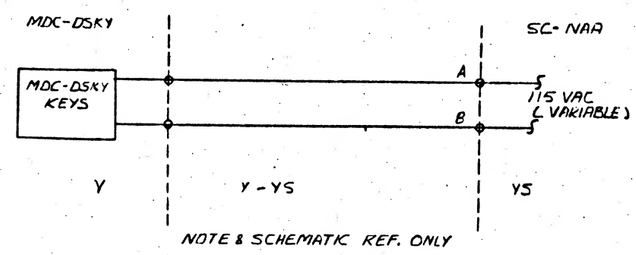
P.F.: 0.5

Noise: Modulation: 0.5 percent

Transients: 50 to 150 volts RMS Recovery in 30 milliseconds to steady state.

Circuits: Y_1
YS_1

10.2 Circuit and Signal Characteristics (Cont.)



NOTE & SCHEMATIC REF. ONLY

All Measurements made from A to B, B Reference

Voltage: 115V ± 4.3 (Controlled 0 - 115 VAC)

Current: 17.5 MA @ 75V (APPROXIMATE)

Frequency: 400 cps ± 7 cps

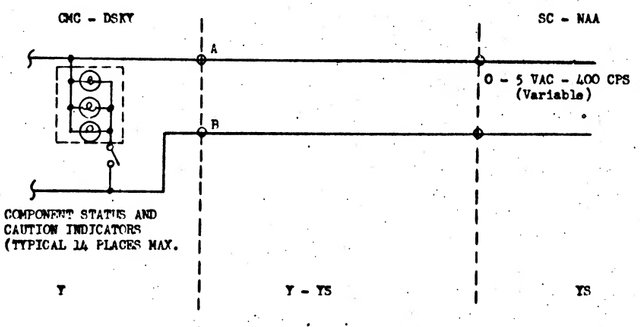
VA: 1.32
Watts: 0.66 MAX.
P.F.: 0.50

Noise: Modulation: 0.5 percent
Transients: 50 to 150 volts RMS Recovery in 30 milliseconds to Steady State.

Circuits:

Y_2
YS_2

10.2 Circuit and Signal Characteristics (Cont.)



NOTE: SCHEMATIC SHOWN FOR REFERENCE ONLY

All Measurements made From A to B, B Reference

Voltage: 5 VAC Variable to Off

Current: 0.180 amps/display (caution indicators)
0.225 amps/display (status indicators)
(2.5 amps max drain on S/C System-for lamp test only)

Operational Current: 720 MA (approximate)

Circuits:

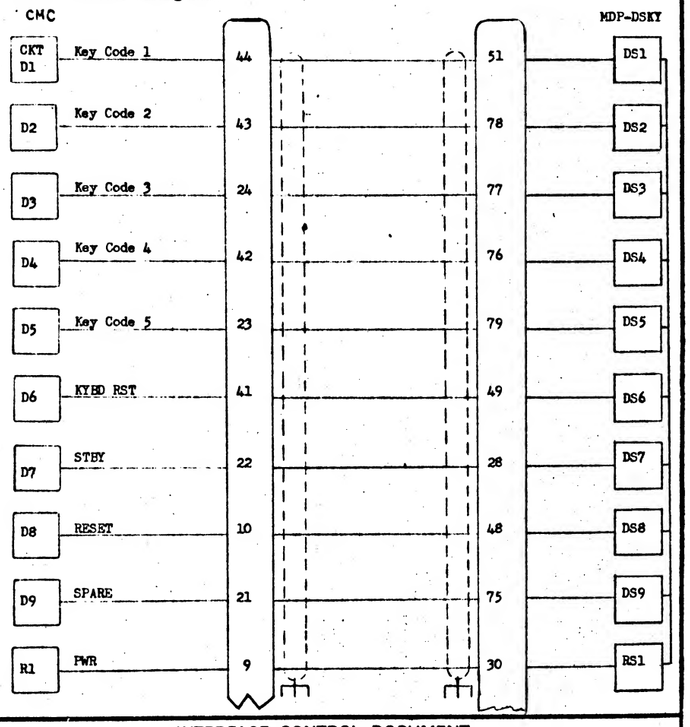
Y_3 and Y_4, Y_5
YS_3 and YS_4 As Shown Above

11.0 Computer to Computer Displays

This section describes the interface between the Computer and Main Display Panel DSKY. The interfaces consist of 67 lines which carry signals from the DSKY to the Computer.

REVISIONS A 1-10-66

11.1 Interface Wiring Data



INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

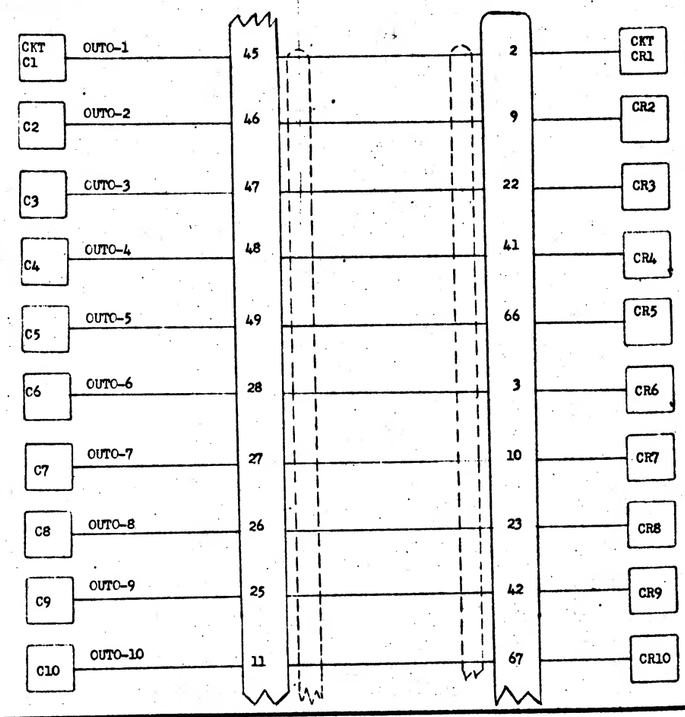
NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 153

FORM 2110-0-00 REV 4-65

11.1 (Cont)



INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

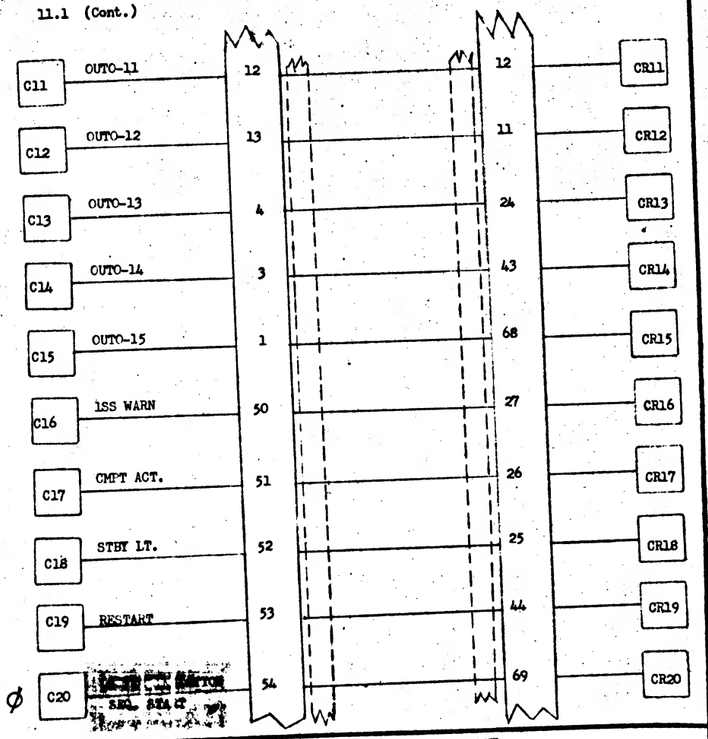
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 154

FORM 2110-0-00 REV 4-65

REVISIONS A 1-10-66

11.1 (Cont.)



INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

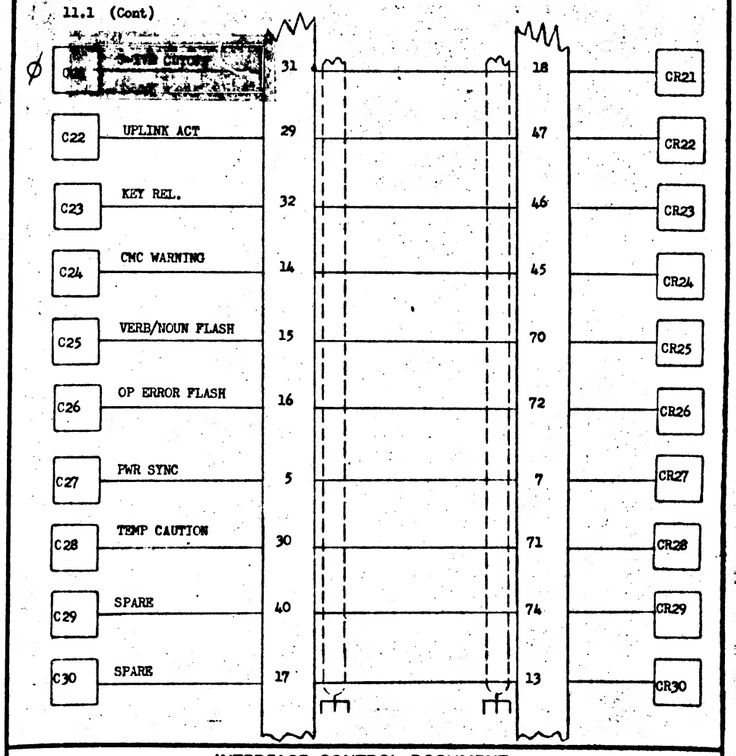
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 155

FORM 2110-0-00 REV 4-65

REVISIONS A 1-10-66

11.1 (Cont)



INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

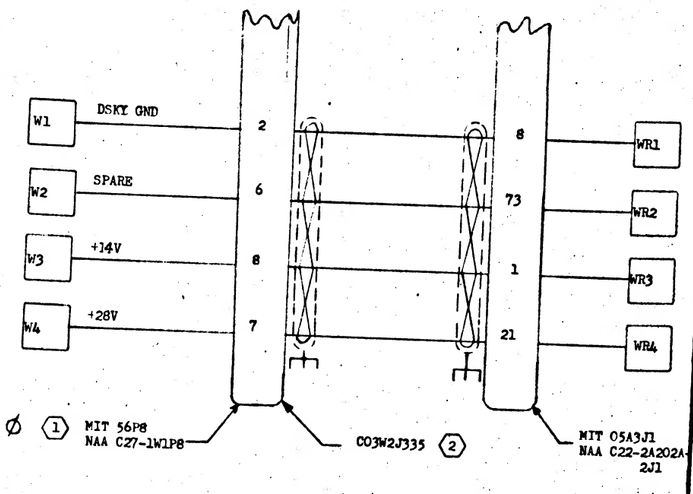
NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 156

FORM 2110-0-00 REV 4-65

11.1 Continued



11.2 Circuit and Signal Characteristics

Waveform Specs

D Circuit

Volt Amp.	0 - 28
Rise Time	< 1 μ sec.
Current Amp	2 MA Maximum
Rise Time	< 1 μ sec.
Frequency	2 pps Maximum

C Circuit

Volt. Amp.	0 - 28
Rise Time	< 1 μ sec.
Current Amp.	5 MA Maximum
Rise Time	< 1 μ sec.

W Circuit

W1	Ground
W2	Spare
W3 Current	100 MA or Less
W4 Current	500 MA (pulsating)

Ø

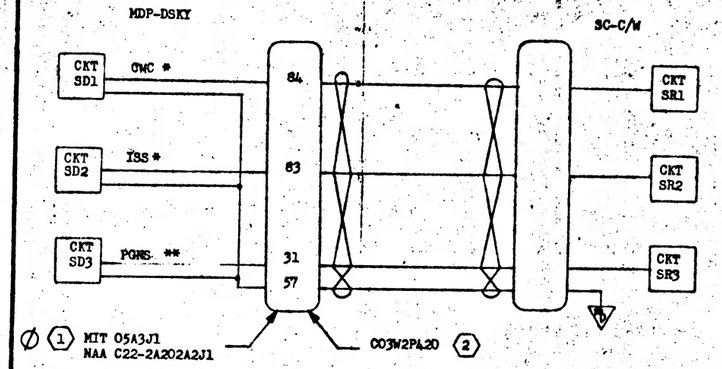
12.0 CMC MDC DSKY to Spacecraft Displays

This interface covers the signals from the CMC which illuminate the caution and warning lights in the "Caution and Warning" subsystem.

There shall be three signals:

1. CMC (Warning) - Indicates a malfunction in the CMC Power Supply or CMC Circuit
2. ISS (Warning) Inertial Subsystem - Indicates a malfunction in the IMU, PIPA Loop, CDU.
3. PGNS (Caution) Primary Navigation/Guidance System - Indicates Gimbal Lock, IMU Temp out of Tolerance, Radar Failure, Program Alarm, Restart (computer).

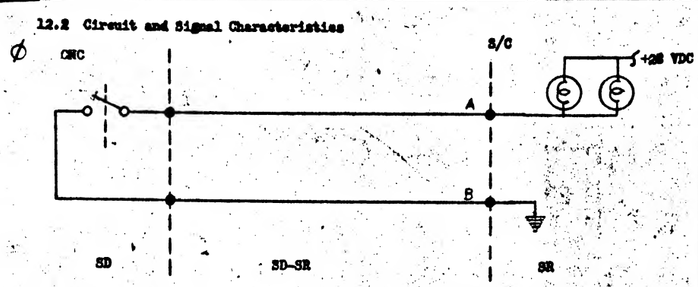
12.1 Interface Wiring Data



* Red Light

** Yellow Light

12.2 Circuit and Signal Characteristics



All measurements made from A to B, B Ref.

Voltage: 28 VDC (nominal from S/C bus)

Current: 180 ma Steady State
1 amp peak for 10 milliseconds

Contact Rating: 0.5 amps @ +28 VDC into lamp load)

Circuits

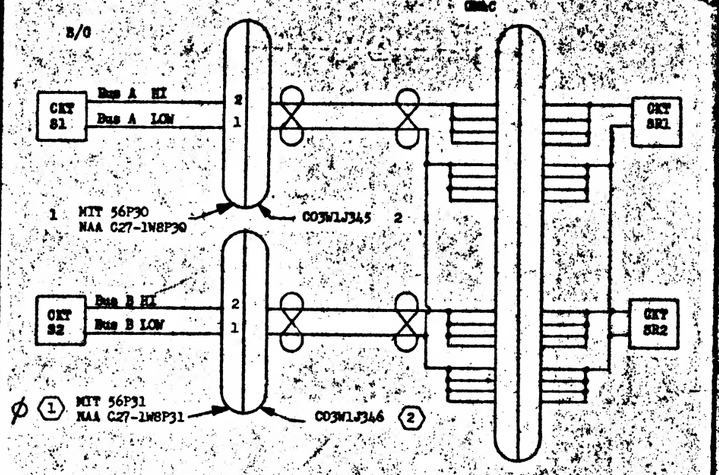
SD1 - SD3 as shown above

SR1 - SR3

13.0 Computer to Spacecraft Power

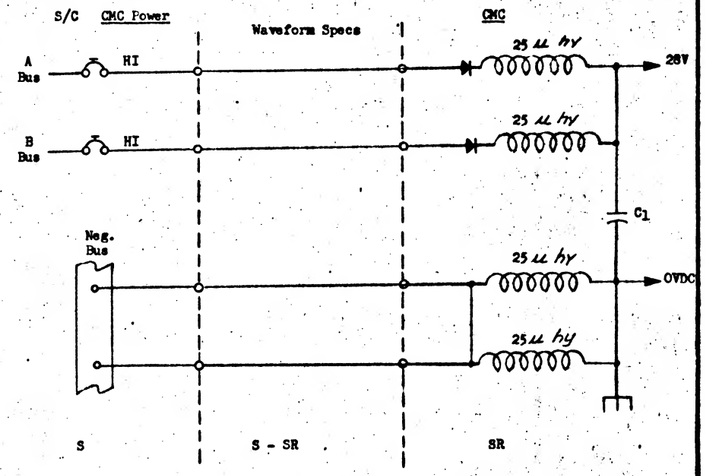
This interface covers the Power interface to the AGC and is included in this ICD for reference only. The Power Interface for the CMC and C shall be covered in ICD MH01-01327-216.

13.1 Interface Wiring Data



NOTE: For Reference Only

13.2 Interface Circuit and Signal Characteristics



All Measurements at CMC Interface

Ø Steady State Voltage: 25.8 to 30.8 at CMC Interface
Variations to S.S.: Per MH01-01327-216
Current: 4.2 amps maximum

Circuits

S1, S2
SR1, SR2

REVISIONS

MH01-01380-216

TDRR 23355 OCT 19 1965

APPROVALS

AUTHORIZED SIGNATURES	REPRESENTING	DATE
[illegible]	NAA/S&ID	9-1-65
D. G. Hoag by W. Stameris	MIT	6 Oct. 65

INTERFACE CONTROL DOCUMENT

DR BY A. Silagyi

CHK BY

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

COMMAND MODULE GUIDANCE COMPUTER
ELECTRICAL INTERFACES BLOCK II
NAA-MIT

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 1 OF 1

REVISIONS

SYM	DESCRIPTION	REQD	REP	DATE	APPROVED

TDRR 23355 OCT 19 1965

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 2

FORM M110-N-9 NEW 4-63

REVISIONS

TDRR 23355 OCT 19 1965

MODEL	PART NO.	DESCRIPTION	APPLICABLE SPEC

EFFECTIVITY AND SPECIFICATIONS

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 3

FORM M110-N-38 NEW 4-63

REVISIONS

TDRR 23355 OCT 19 1965

Note: Unless Otherwise Specified

1. Massachusetts Institute of Technology
   Instrumentation Laboratory
   Cambridge, Massachusetts

2. North American Aviation, Inc.
   Space and Information Systems Division
   Downey, California

3. Design Data Required

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 4

REVISIONS

IDRR 23355 OCT 19 1965

TABLE OF CONTENTS

1.0 SCOPE

This ICD defines all of the electrical interfaces that are associated with the Command Module Guidance Computer. It will specify the characteristics, wiring, and shielding of each.

There are various input and output circuits associated with the CMC. These circuits are categorized as follows:

Y, YS - Y: Input transformer circuit; YS: source for "Y" circuit.
X, XR - X: Output transformer circuit; XR: receiver of "X" circuit.
D, DS - D: DC input circuitry; DS: source for the "D" circuit.
C, CR - C: DC output circuit; CR: receiver for "C" circuit.
S, SR - S: Switch closure; SR switch closure receiver.
W, WR - W: Just a wire connection; WR: receiver for "W".
R - R: DC power source.

The numbers following any particular designation (C2, X2, CR2, XR2, etc.) together with the section numbers uniquely designates a particular CMC output circuit or input circuit.

1.1 Grounding Symbology

The following drawing symbology shall be used throughout this ICD:

a) AC Grounds
   1. AC Power
   2. AC Signal

b) DC Ground
   1. DC Power
   2. DC Signal Ground

c) Isolated Circuit Ground

d) Structure Ground

e) Vehicle Ground Point

2.0 Waveform and Noise Measurement Techniques

1. Pulse Measurements

   a. Measurements to be made at points indicated in appropriate sections of this ICD.

   b. Measurements to be made with Tektronix 540 series, type 1A1 differential preamp, 10/1 attenuator probes; or equivalent. Scope to be grounded at CMC only, if at all.

2. Noise Measurements

   a. Measurements to be made with Tektronix 540 series, type CA preamp, and P6016 current probe and type 131 amplifier; or equivalent.

   b. The current to voltage conversion factor will be the load pulse impedance (200 ohms; XR, Y) or DC impedance (22K ohms; CR, D) where applicable.

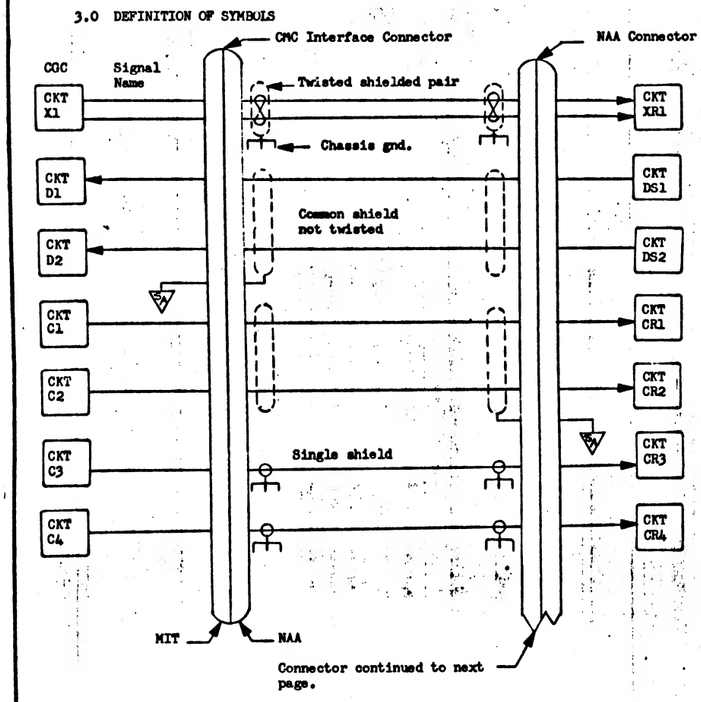
3. AC Measurements

   a. Hewlett-Packard 400D or equivalent.

4. DC Measurements

   a. Scope or equivalent.

3.0 DEFINITION OF SYMBOLS



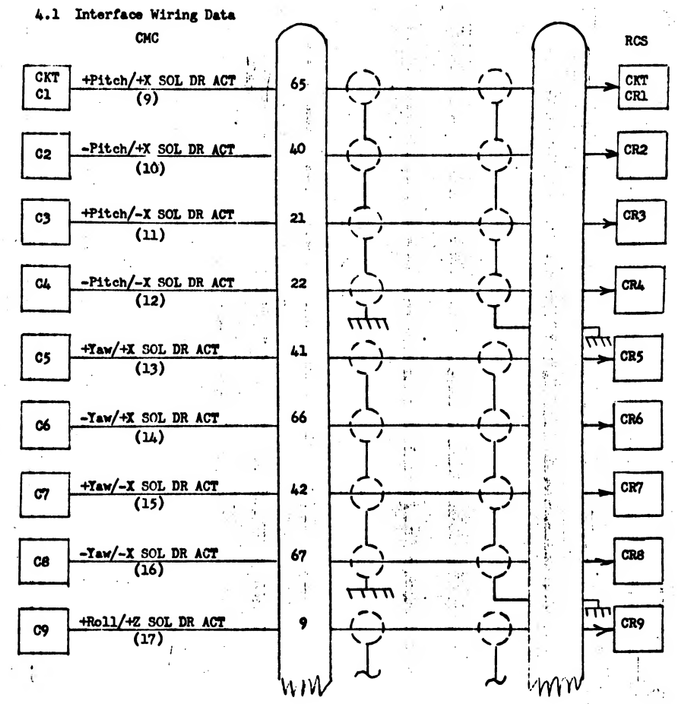
REVISIONS

4.0 CMC to RCS Drivers

This section describes the interface between the Apollo Guidance Computer and the SCS Reaction Control System. The Apollo Guidance computer will provide output-discrete to SCS reaction jet drivers to command reaction jet firing. There will be a total of 16 output lines provided, each line carrying the ignition command for one of the 16 S/M reaction jets or one of the 12 C/M reaction jets with the remaining four lines having no function when the SM is detached. The presence of high voltage on a line as referenced to spacecraft ground will indicate a jet OFF discrete.

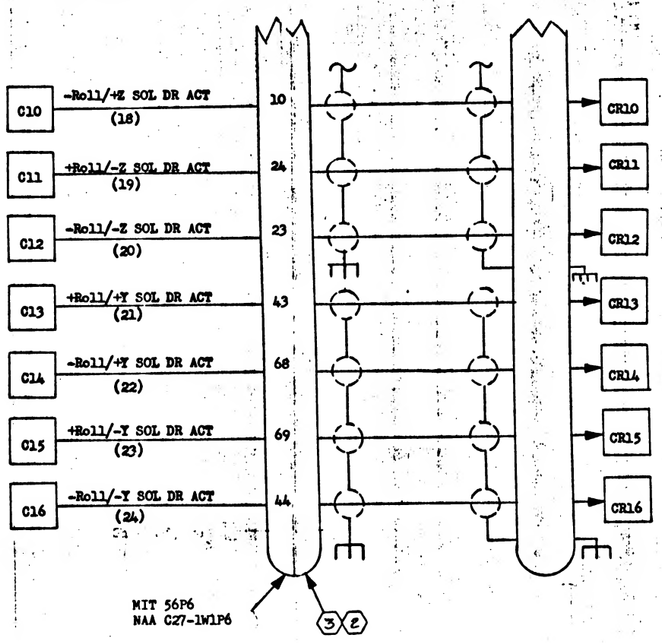
REVISIONS

4.1 Interface Wiring Data



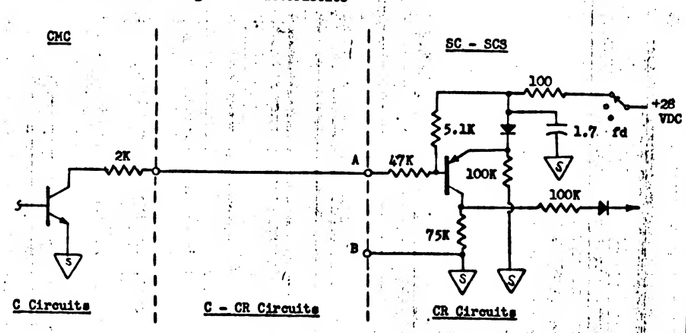
REVISIONS

4.1 Interface Wiring Data (Continued)



REVISIONS

4.2 Circuit and Signal Characteristics



All Measurements Made from A to B, B Ref.

Amplitude:	"ON"	5 VDC ± 5 VDC
	"OFF"	28 VDC ± 5 VDC
Current:	"ON"	5 MA Max
Source Impedance:	"ON"	3K Max to CMC Gnd, 0-5MA Range
	"OFF"	0.5 Meg Ohms, 0-40 Volt Range
Source Rise Time:		Less than 1 μ sec.
Noise Rejection:	"ON"	+80V Noise pulse, max width 0.5 millisec, maximum rep rate 10 pps
	"OFF"	-20V Noise pulse, max width 1 millisec, maximum rep rate 10 pps
Circuits:	C1-C16	Shown Above
	CR1-CR16	Shown Above

NOTE: SCHEMATICS SHOWN FOR REFERENCE ONLY

5.0 CONTROL MODE AND STATUS SIGNALS

5.1 Signal Definitions

5.1.1 LEM Attached (△ V CG, LEM/CSM - CSM)

The LEM Attached signal will be a switch closure on the Command Module Main Display Panel. This switch closure will be pilot initiated upon completion of LEM transposition and docking.

5.1.2 SPS Ready (△ V Thrust, Normal - Off - Direct On)

The SPS Ready signal will be provided by a switch closure on the Command Module Main Display Panel. This switch closure will be pilot initiated and will indicate procedurally the completion of the pre Delta V checkout procedure. The SPS engine cannot be fired unless this discrete is present.

5.1.3 Attitude Hold (SC Control, CMC, Auto - Hold - Free)

The Attitude Hold signal will be a switch closure on the Command Module Main Display Panel. This switch will be pilot initiated at such time, during primary control, as it is desired to hold the present attitude of the spacecraft.

5.1.4 Free Drift (SC Control, CMC, Auto - Hold - Free)

The Free Drift signal will be a switch closure on the Command Module Main Display Panel. This switch will be pilot initiated at such time, during primary control, as it is desired to inhibit automatic control and permit manual control of the spacecraft through the CMC (hand controllers, minimum impulse).

5.1.5 Accept Uplink (UPTLM, Accept - Block)

The Accept Uplink signal will be a switch closure on the Command Module Main Display Panel. This switch will be pilot initiated at such time as it is desired to receive information via the updata link. A similar switch shall be provided in the LEB. Both switches must be in accept position to receive uplink data.

5.1.6 C/M - S/M Separate

The Service Module Separation signal will be a parallel contact closure within the SM/CM Reaction Jet Control Transfer unit. This contact closure indicates initiation of SM separation. The contact closure occurs 110 milliseconds prior to physical separation of CM/SM. The

switch transfer time is 100 milliseconds maximum.

5.1.7 SIV-B Separate

The S-IVB Booster Separation Signal will be a contact closure within the Spacecraft Master Events, Sequence Controller. This contact closure indicates S-IVB booster separation and shall occur simultaneously with the firing of the Service Module, LEM Adapter (SLA) separation Pyros.

5.1.8 Lift Off

The "Lift Off" signal will be a switch closure in the S-IVB Instrumentation Unit. The signal indicates that the IU umbilical has been removed and that the vehicle is in the lift-off phase.

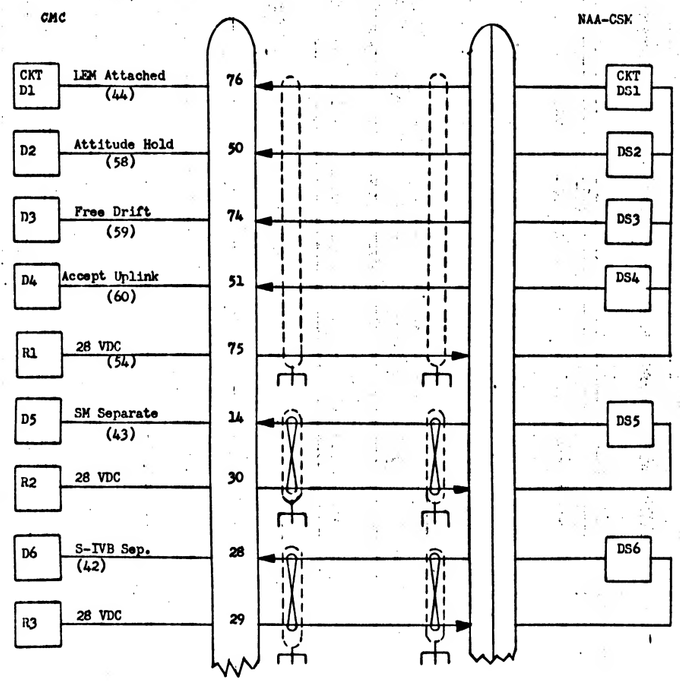
5.1.9 Guidance Reference Release

The Guidance Release signal will be a switch closure in the S-IVB Instrumentation Unit. This signal will indicate that the Saturn IU external pre-launch alignment control has been removed and the IU is inertially stabilized.

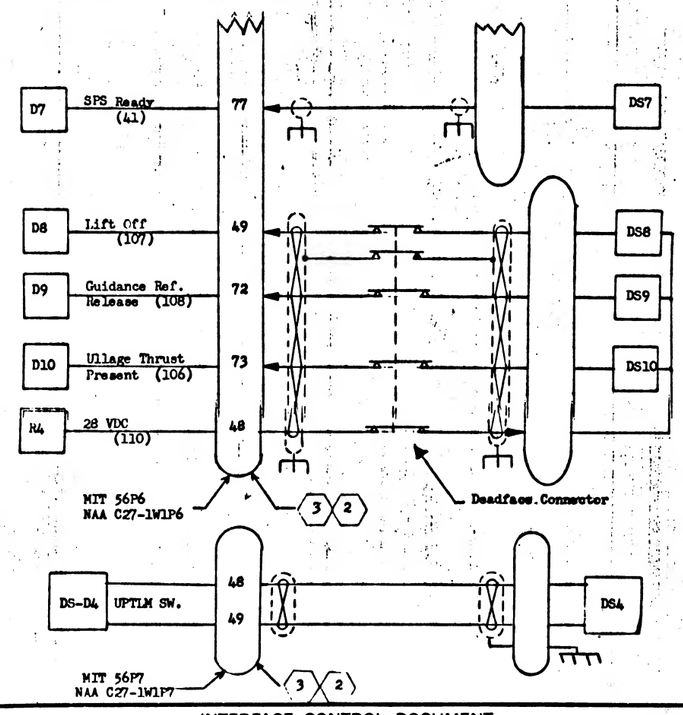
5.1.10 Ullage Thrust Present

The Thrust Monitor signal shall be a switch closure in the S-IVB Instrument Unit. The signal shall indicate the presence of thrust on the S-IVB due to ullage.

5.2 Interface Wiring Data

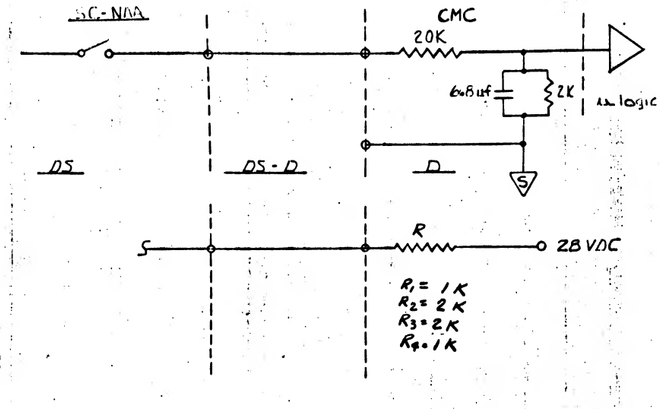


5.2 Interface Wiring Data (Cont.)



REVISIONS

5.3 Circuit and Signal Definition



All Measurements Between Points A, B, B Reference

Amplitude "1" 28 ± 11 VDC
Amplitude "0" 0 ± 2 VDC

Noise Susceptibility:

DS Open: +80V Noise Pulse, Max Width 1 Millisecond, maximum Rep. Rate 10 pps
DS Closed: -20V Noise Pulse, Max Width 0.5 Millisecond, maximum Rep. rate 10 pps

Circuits

D1, 2, 3, 5, 6, 8, 9, 10
DS1, 2, 3, 5, 6, 8, 9, 10 As Shown Above
R1 - R4

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

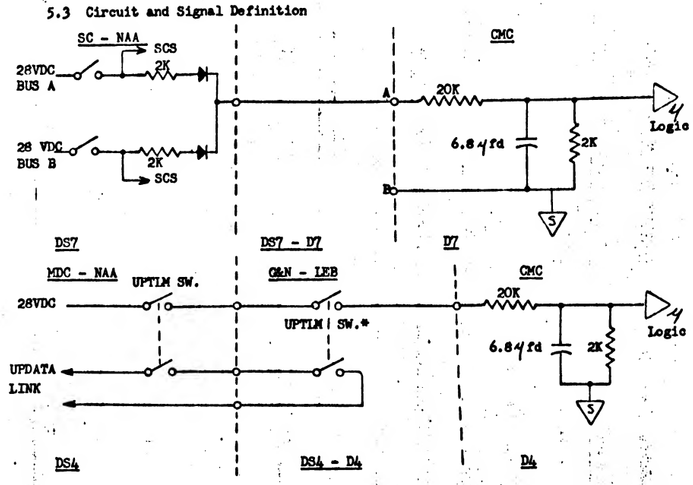
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 17

FORM 8110-N-56 NEW 4-65

REVISIONS

5.3 Circuit and Signal Definition



All Measurements Between Points A, B, B Reference

Amplitude "1" 28 ± 11 VDC
Amplitude "0" 0 ± 2 VDC

Noise Susceptibility:

DS Open: +80V Noise Pulse, Max Width 1 Millisec, maximum Rep. Rate 10 pps
DS Closed: -20V Noise Pulse, Max Width 0.5 Millisec, maximum Rep. Rate 10 pps

*Note: Contact rating of "UPTLM SW.": 28 VDC, 0.5 Amps

Circuits: D4, D7 As Shown Above
DS4, DS7

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 18

FORM 8110-N-56 NEW 4-65

REVISIONS

6.0 ATTITUDE SIGNALS FROM GYRO DISPLAY COUPLER (GDC)

This section describes the interface between the CMC and GDC's in the SCS system. The GDC's, driven from the BMAG's, shall provide attitude information to the G&N CMC. The signals shall be in digital form transmitted as two wire signals isolated from ground in both the SCS and CMC. The interface shall consist of six signals (two wires per polarity per axis).

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

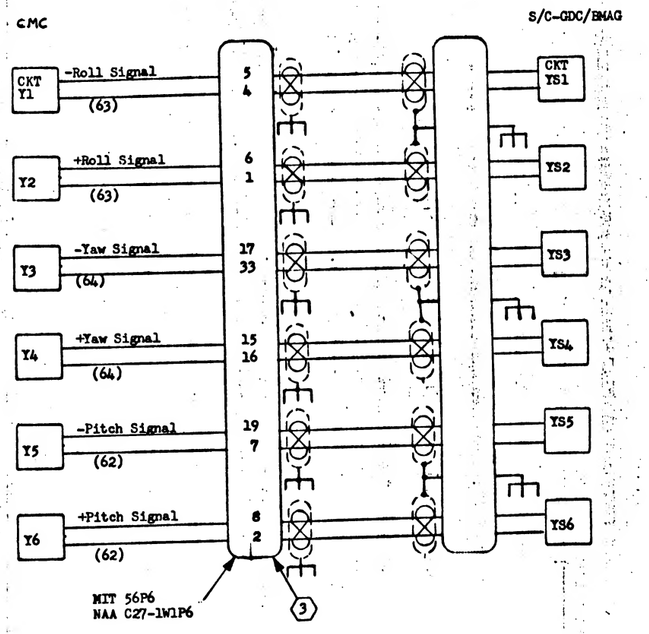
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 19

FORM 8110-N-56 NEW 4-65

REVISIONS

6.1 Interface Wiring Data



INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

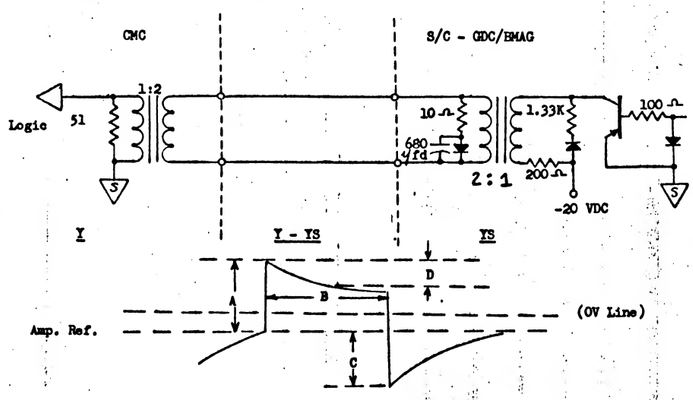
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 20

FORM 8110-N-56 NEW 4-65

REVISIONS

6.2 Circuit and Signal Characteristics



Input Signal Specified at G&N Interface

1. Load Impedance: 200 ± 10% ohms
2. Source Impedance: 100 ohms maximum
3. Signal Characteristics:
   a. Signal Amplitude: (A) 7 ± 3 volts
   b. Pulse Width: (B) 2-6μ sec (@A/2 point)
   c. Backswing: (C) 4V maximum
   d. Droop: (D) 20% at 24μ sec point
   e. Rise Time: (10-90% of A) 0.5μ sec maximum
   f. Zero Volt: The zero volt line is defined as the mean value of the waveform.
   g. Delta Angle: Each pulse appearing on the line shall represent 0.1 ± 8% degrees. The maximum PRR is 640 pps.

NOTE: SCHEMATIC FOR REFERENCE ONLY

REVISIONS

6.2 (Continued)

h. Noise Specification

1. Noise during the transmission of the pulse: The signal plus noise shall remain within the envelope of amplitude defined above (A,B).

2. Noise during the absence of the pulse: +0.4 volts max, -4.0 volts max; measured with respect to the amplitude reference (See Figure).

i. Presence of the pulse shall indicate "ON" condition. Absence of pulse shall indicate "OFF" condition.

Circuits

Y1 - Y6 Shown above, CMC Transformer: NASA Brawing 1006319

YS1 - YS6 Shown above

REVISIONS

7.0 MAIN ENGINE AND SATURN ENGINE CONTROL SIGNALS

This section describes the interface between the CMC and the SPS Drivers. The CMC provides an output-discrete signal to the SPS solenoid driver circuitry to command SPS firing. One line will be provided for this command. The presence of voltage on this line as referenced to spacecraft ground shall command main engine OFF.

In addition, the CMC will provide two signals to the S-IVB Instrument Unit. These signals are:

1. S-IVB Engine Fire Cycle

   This signal will initiate the S-IVB engine firing sequence for translunar injection. The signal shall be a switch closure in the MDP-DSKY causing a 28 VDC signal to be sent to the Saturn Instrument Unit.

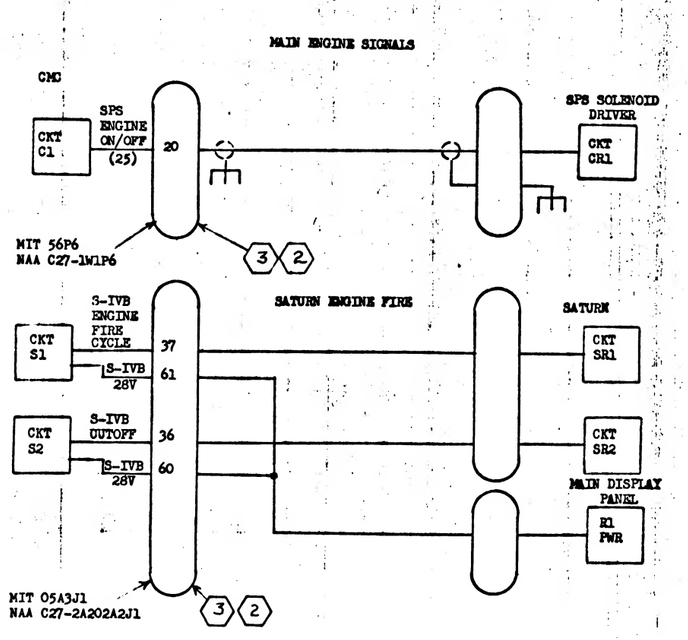
2. S-IVB Cutoff

   This signal commands the termination of main engine thrusting. This signal will be initiated by a switch closure in the MDP-DSKY and will send Saturn 28 VDC power back to the Saturn IU.

The 28 VDC power for the above Saturn signals shall be routed from the Saturn Instrument Unit through the Saturn control switch to the DSKY relays on the Main Display Panel.

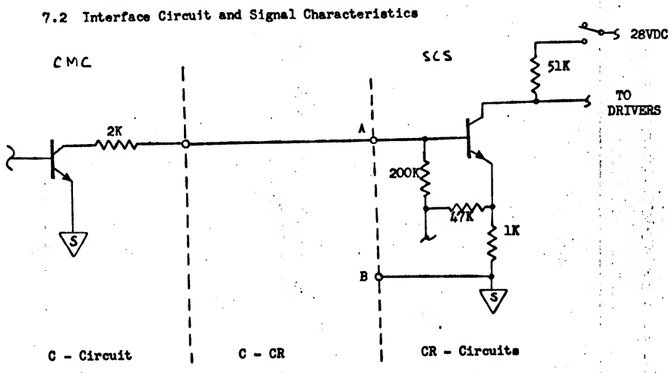
REVISIONS

7.1 Interface Wiring Data



REVISIONS

7.2 Interface Circuit and Signal Characteristics



NOTE: Schematics Shown for Reference Only

All Measurements Made From A to B, B Ref.

Amplitude: "ON" 5V ± 5V
"OFF" 28V ± 5V

Current: ON 5 ma Maximum

Source Impedance: "ON" 3K Max to CMC Ground, 0-5 MA Range
"OFF" 0.5 Meg Ohms, 0-40 Volt Range

Source Rise Time: Less than 1 μsec

Noise Rejection: "ON" +80V Noise Pulse, Max Width 0.5 Millisec, Max. Rep. Rate 10 pps
"OFF" -20V Noise Pulse, Max Width 1 Millisec, Max Rep. Rate 10 pps

Circuits: C1 and CR1

INTERFACE CONTROL DOCUMENT

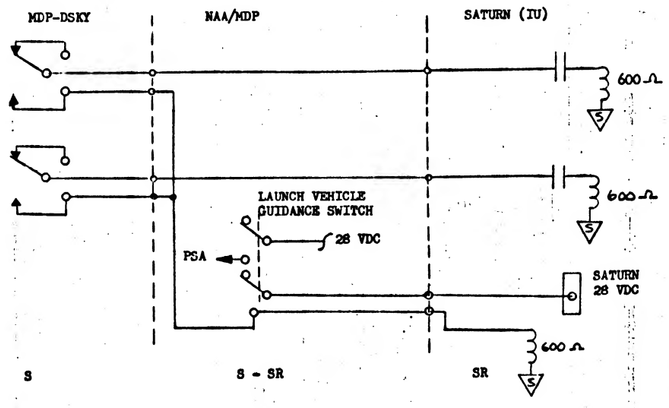
THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216
		SHEET 25

REVISIONS

7.2 Continued



Circuits:

NOTE: SCHEMATICS SHOWN FOR REFERENCE ONLY

S Circuit

Voltage: 28 ± 4 VDC

Current: 0.5 amps Maximum

Switch Shown in OFF Position

S-SR Circuits (Refer to ICD MH01-01344-216 for additional details)

Voltage: 28 ± 4 VDC

Current: 0.5 amps Maximum

SR Circuits

Voltage: 28 VDC Current: 50 Milliamps

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216
		SHEET 26

REVISIONS

8.0 Rotational and Translational Controller Signals

8.0.1 Rotational Hand Controller - The SCS shall provide discrete D-C output signals through the rotational hand controllers to the CMC whenever the controller is activated mechanically by astronaut motion. There shall be six lines representing commands of positive and negative rotation in all three axes from the two controllers.

8.0.2 Translational Hand Controller - The SCS shall provide discrete d-c output signals through the rotation control to the CMC whenever the controller is activated mechanically by astronaut motion. There shall be six lines representing commands of positive and negative translation in all three axes.

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

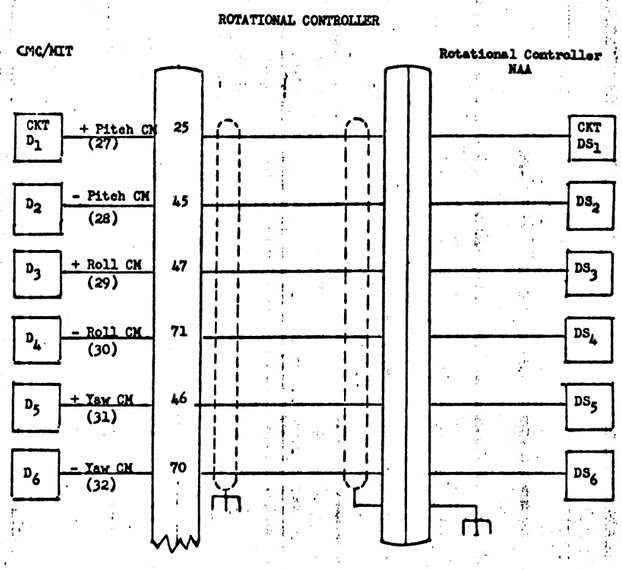
NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216
		SHEET 27

FORM NIIO-N-50 NEW 4-60

REVISIONS

8.1 Interface Wiring Data



INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

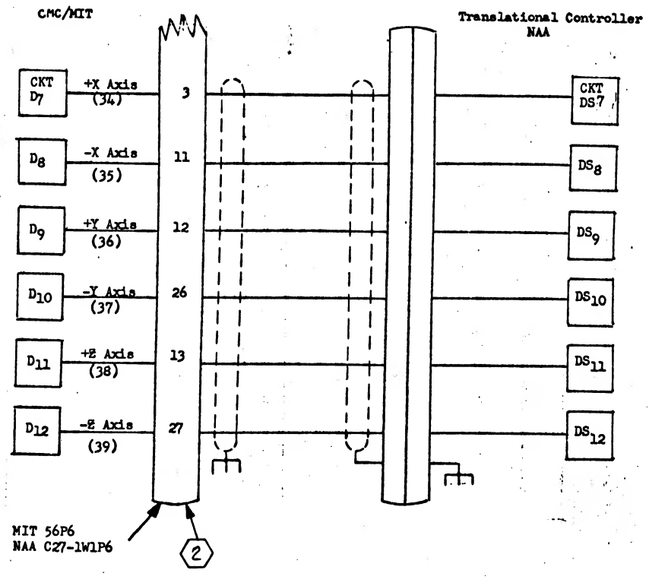
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216
		SHEET 28

FORM NIIO-N-50 NEW 4-60

REVISIONS

8.1 Interface Wiring Data (Continued)

TRANSLATIONAL COMMANDS



INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

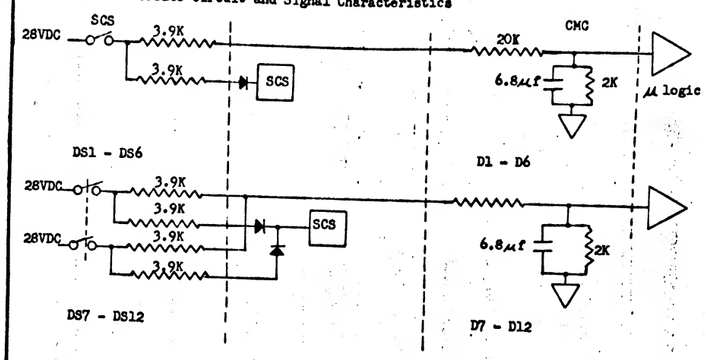
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 29

FORM MIIO-N-50 NEW 4-65

REVISIONS

8.2 Interface Circuit and Signal Characteristics



All measurements made from Points A to B, B Ref.

NOTE: SCHEMATIC FOR REFERENCE ONLY

Signal Characteristics:

Circuits

D1 - D12 As shown
DS1 - DS12 As shown

a. "ON" Signal

(1) Voltage: 28 + 11 VDC
(2) Current: 0.01 Amps
(3) Source Impedance: 3.9K Ohms Nominal - Rotation Control
1.95 Ohms Nominal - Translation Control

b. "OFF" Signal

(1) Voltage: +2, -5 VDC
(2) Source Impedance: 100K (Minimum)

c. Noise Rejection

(1) DS Open: +80 V noise pulse, maximum width 1 millisec maximum rep rate 10 pps
(2) DS Closed: -20 V noise pulse, maximum width 0.5 millisec maximum rep rate 10 pps

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 30

FORM MIIO-N-50 NEW 4-65

REVISIONS

9.0 MASTER CLOCK AND TELEMETRY

9.0.1 Master Clock

The G&N System shall provide a synchronising pulse from the CMC. This timing pulse will be used to synchronize the NAA Central Timing Equipment with the Computer.

9.0.2 Telemetry

There will be two interfaces with PCM equipment:

1. Downlink - The Downlink shall consist of eight lines, two each for Downlink data, Downlink start, Downlink end, and Downlink sync. This link shall be used to transmit data to the ground via telemetry.

2. Uplink - The uplink will consist of four lines, two each for Uplink "0" and Uplink "1". This link shall be used to transmit data from the ground via Up-Data Link.

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

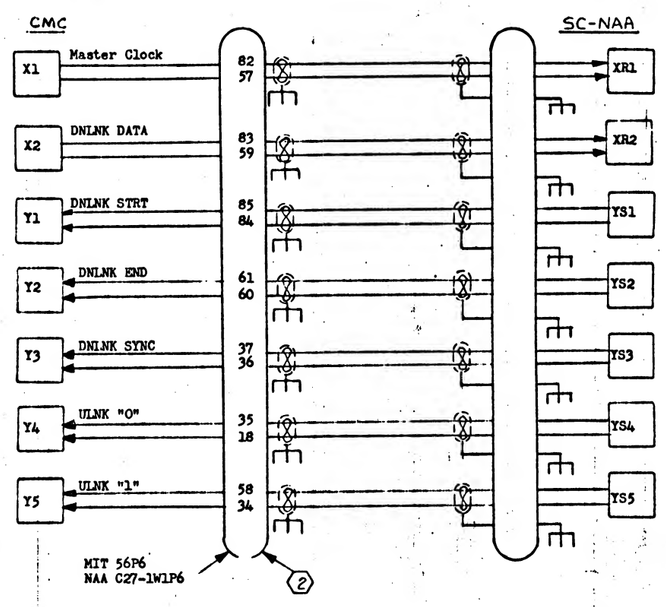
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 31

FORM MIIO-N-50 NEW 4-65

REVISIONS

9.1 Interface Wiring Data



INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

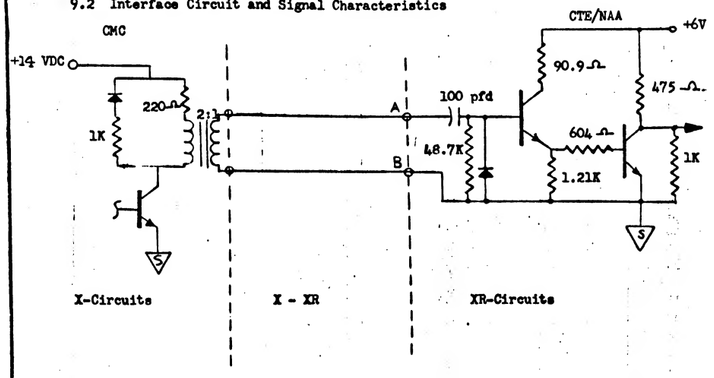
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 32

FORM MIIO-N-50 NEW 4-65

REVISIONS

9.2 Interface Circuit and Signal Characteristics



NOTE: Schematics Shown for Reference Only

All Measurements Made from A to B, B Ref.

1. Load Impedance - 500 ohms (approximate)

2. Source Impedance:

   a. Impedance during pulse - 100 ohms (approx)
   b. Resistance of Winding - 10 ohms maximum
   c. Inductance of winding - 10 mh (maximum)

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

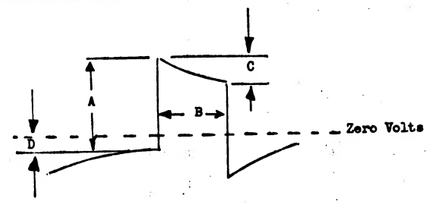
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216
		SHEET 33

FORM 3110-N-58 NEW 6-63

REVISIONS

9.2 Continued

3. Signal Characteristics at GN&C Interface
   (Test Load of 510 ohms)



a) Amplitude (A) = 4 to 14 volts
b) Pulse width (B) +0.5 ± 0.25 μ sec.
c) Zero Shift (D) = 50% of A (Approx.)
d) Rise time (10% to 90% of A) = 0.2 μ sec. max.
e) Noise and ripple - 0.2 volts max.
f) Frequency - 1024 KC ± 2 PPM
g) Zero volt line is defined as the mean value of the waveform.
h) Grounding: The master clock output signal end shall be [illegible] ground isolated in the G&N System.
i) Presence of pulse shall indicate "ON" condition.
   Absence of pulse shall indicate "OFF" condition.

Circuits

X1 Shown above, CMC Transformer: NASA Drawing No. 1006319

XR1 Shown Above

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

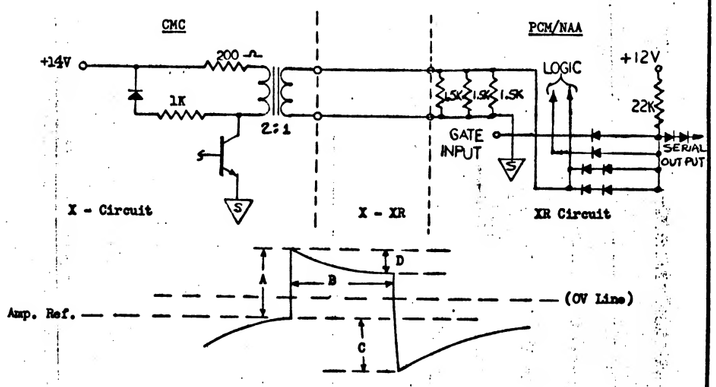
NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216
		SHEET 34

FORM 3110-N-58 NEW 6-63

REVISIONS

9.2 Continued



Interface Signal Specified at G&N Interface

1. Load Impedance: 500 ± 10% ohms nominal, note XR circuit above.

2. Source Impedance: 100 ohms maximum, note X circuit above.

3. Signal characteristics at the G&N Interface
   (Test load of 510 ohms ± 10% acceptable)

   a. Amplitude (A) 7 ± 3V

   b. Pulse Width (B) 2.5 to 6 μ sec. at A/2 Point

   c. Backswing (C) 6V maximum

   d. Droop (D) 15% of "A" maximum at 2 μ sec. maximum

NOTE: SCHEMATICS SHOWN FOR REFERENCE ONLY

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216
		SHEET 35

REVISIONS

9.2 Continued

e. Rise Time (10-90% of A) 0.2 μ sec maximum

f. Zero Volt: The zero volt line is defined as the mean value of the waveform and is determined by the pulse shape and repetition rate.

g. Noise Specification

   1. Noise during the transmission of the pulse:
      The signal plus noise shall remain with the envelope of amplitude defined above (A,B).

   2. Noise during the absence of the pulse:
      +0.4 volts max, -4.0 volts max; measured with respect to the amplitude reference (see Figure).

h. Presence of the pulse shall indicate "ON" condition.
   Absence of pulse shall indicate "OFF" condition.

Circuits

X2 shown above, CMC transformer: NASA Drawing No. 1006319

XR2 to be furnished, NAA

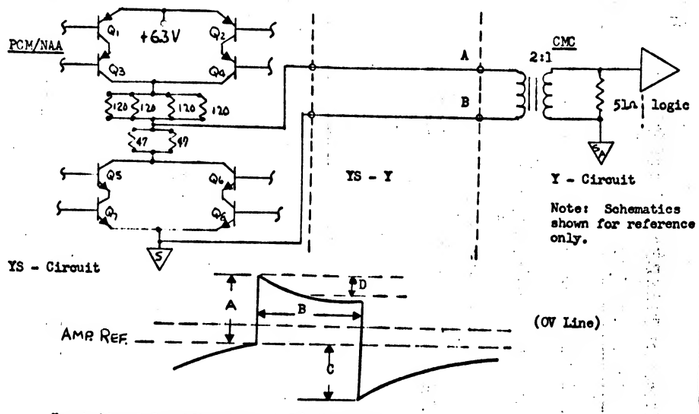
INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216
		SHEET 36

9.2
Continued



Input Signal Specifications at G/N Interface

1. Load impedance: 200 ohms nominal, note Y circuit above.
2. Source Impedance: 100 ohms max.
3. Signal characteristics at G/N interface (Test load of 200 ohms ± 10% acceptable)
   a. Amplitude (A) 4.5 ± 1V
   b. Pulse Width (B) 4.5 ± 1.5μsec (at A/2 point)
   c. Droop (D) 15 % of "A" at 2μ sec max
   d. Rise Time (10-90% of A) 0.2μ sec max
   e. Zero Volt: The zero volt line is defined as the mean value of the waveform and is determined by the pulse shape and repetition rate.

9.2 Continued

g. Noise Specification

1. Noise during the transmission of the pulse: The signal plus noise shall remain within the envelope of amplitude defined above (A,B).
2. Noise during the absence of the pulse: +0.4 volts max, -4.0 volts max; measured with respect to the amplitude reference (see Figure).

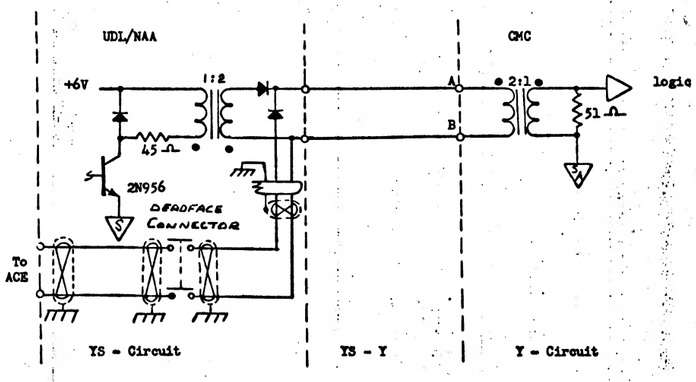
h. Presence of the pulse shall indicate "ON" condition. Absence of pulse shall indicate "OFF" condition.

Circuits

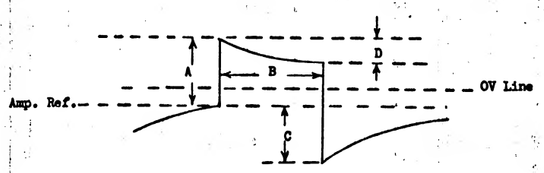
Y1 - Y3 shown above, CMC transformer: NASA Drawing No. 1006319

YS1 - YS3 to be furnished, NAA

9.2 Continued



NOTE: Schematics shown for reference only.



Input Signal Specifications at G&N Interface

1. Load Impedance: 200 ohms nominal, note Y circuit above.
2. Source Impedance (Maximum): 220Ω During Pulse

9.2 Continued

3. Signal Characteristics at G&N Interface (Test load of 200 ohms ± 10% acceptable)
   a. Amplitude (A) 7 ± 3V
   b. Pulse Width (B) 2-6μ sec (at A/2 point)
   c. Backswing (C) 4V maximum
   d. Droop (D) 20% of "A" maximum
   e. Rise Time (10-90% of A) 1μ sec maximum
   f. Zero Volt: The zero volt line is defined as the mean value of the waveform and is determined by the pulse shape and repetition rate.
   g. Noise Specification
      1. Noise during the transmission of the pulse:
         The signal plus noise shall remain within the envelope of amplitude defined above (A, B).
      2. Noise During the absence of the pulse:
         +0.4 volts maximu, -4.0 volts maximum; measured with respect to the amplitude reference (see Figure).
   h. Presence of the pulse shall indicate "ON" condition. Absence of the pulse shall indicate "OFF" condition.

Circuits

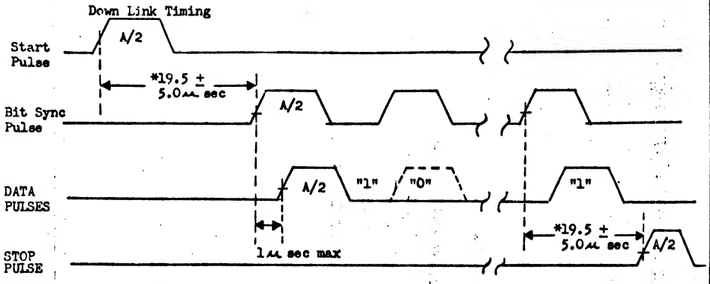
Y4 - Y5 Shown above, CMC transformer: NASA Drawing No. 1006319

YS4 - YS5 To be furnished, NAA

REVISIONS

9.2 Continued

Down Link Timing



a. Start pulses: Normal rate 50 pps, low rate 10 pps.

b. Bit sync pulses: Normal rate 51.2 Kpps, low rate 1.6 Kpps. There will be 40 pulses per burst.

c. Data pulses: Frequency and width determined by bit sync pulses. A "1" is the presence of a pulse and a zero as the absence of a pulse with a bit sync pulse.

d. Stop pulses: Normal rate 50 pps, low rate 10 pps.

e. During CMC "Standby Mode", data is all "1's".

* Time shown hold for normal data rate; for low data rate replace 19.5 ± 5μ sec by 625 ± 156μ sec.

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

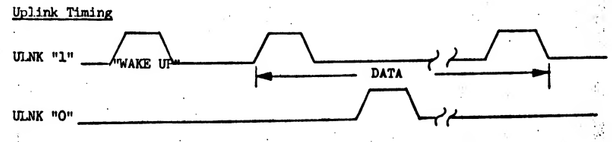
SHEET 41

FORM M110-N-58 NEW 4-68

REVISIONS

9.2 (Continued)

Uplink Timing



a. Bit rate of 0's and 1's is 1.1 Kpps maximum.

b. 1 word is composed of 16 pulses; a "wake up" bit on the "1" line followed by 15 bits on the "1" or "0" lines.

c. Minimum time between words is 0.1 seconds.

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 42

FORM M110-N-58 NEW 4-68

REVISIONS

10.0 CM Computer Display Keyboard (DSKY) Illumination Power

This section covers the electrical interface for the MDC-DSKY and the LEB-DSKY Illumination. NAA will provide power and dimming controls for EL integral lighting (keys), alpha numerics, and the advisory and component status lights.

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

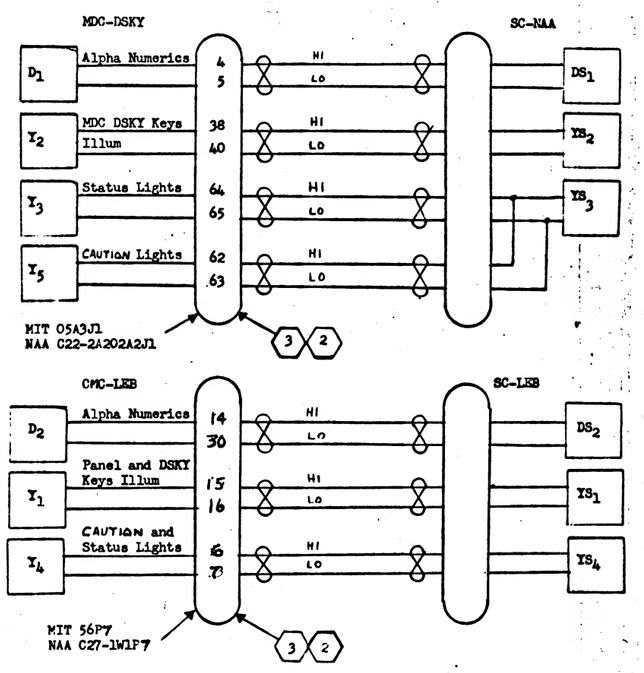
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 43

FORM M110-N-58 NEW 4-68

REVISIONS

10.1 Interface Wiring Data



INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

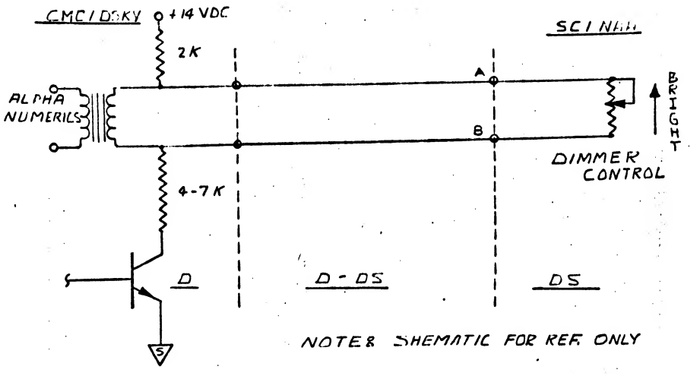
NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 44

REVISIONS

10.2 Circuit and Signal Characteristics



All Measurements Made from A to B, B Reference

Waveform: 800 cps Square Wave, 14 VDC maximum.

Current: 2MA Maximum

Dimmer Control:

Type - 10K ± 5%
Taper - (3) (2)

Circuits:

D_1 and D_2
DS_1 and DS_2

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

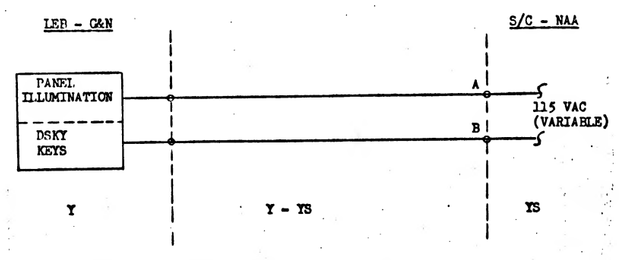
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 45

FORM MIIO-N-56 NEW 6-65

REVISIONS

10.2 Circuit and Signal Characteristics (Continued)



NOTE: SCHEMATIC FOR REFERENCE ONLY

All Measurements Made from A to B, B Reference

Voltage: 115V ± 4.3 (Controlled 0 - 115 VAC)

Current: 317.5 MA @ 75V (APPROXIMATE)

Frequency: 400 cps ± 7 cps

VA: 23.8

Watts: 10.66

P.F.: 0.5

Noise: Modulation: 0.5 percent

Transients: 50 to 150 volts RMS Recovery in 30 milliseconds to steady state.

Circuits: Y_1
YS_1

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

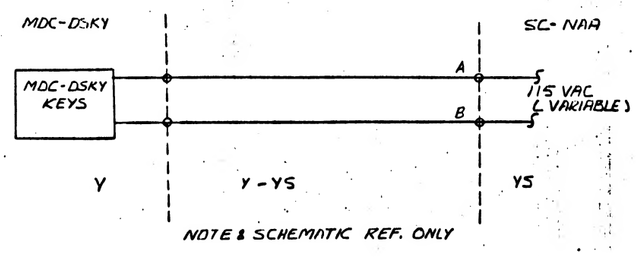
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 46

FORM MIIO-N-56 NEW 6-65

REVISIONS

10.2 Circuit and Signal Characteristics (Cont.)



All Measurements made from A to B, B Reference

Voltage: 115V ± 4.3 (Controlled 0 - 115 VAC)

Current: 17.5 MA @ 75V (APPROXIMATE)

Frequency: 400 cps ± 7 cps

VA: 1.32
Watts: 0.66
P.F.: 0.50

Noise: Modulation: 0.5 percent
Transients: 50 to 150 volts RMS Recovery in 30 milliseconds to Steady State.

Circuits:

Y_2
YS_2

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

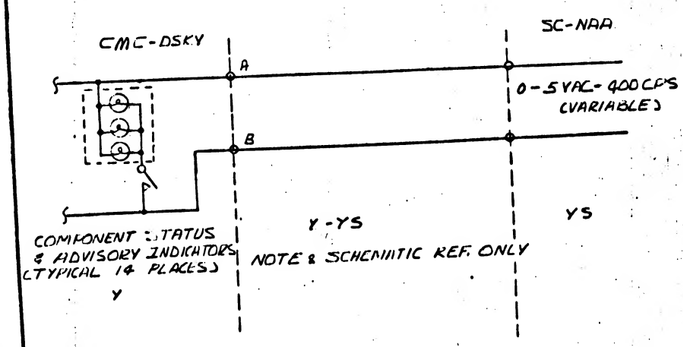
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET

FORM MIIO-N-56 NEW 6-65

REVISIONS

10.2 Circuit and Signal Characteristics (Cont.)



All Measurements made from A to B, B Reference

Voltage: 5 VAC variable to Off

Current: 0.180 amps per Display
(2.5 amps maximum drain on S/C System - for Lamp Test Only)

Operational Current: 720 MA (approximate)

Circuits:

Y_3 and Y_4, Y_5 As Shown Above
YS_3 and YS_4,

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET

FORM MIIO-N-56 NEW 6-65

REVISIONS

11.0 Computer to Computer Displays

This section describes the interface between the Computer and Main Display Panel DSKY. The interfaces consist of 47 lines which carry signals from the DSKY to the Computer.

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

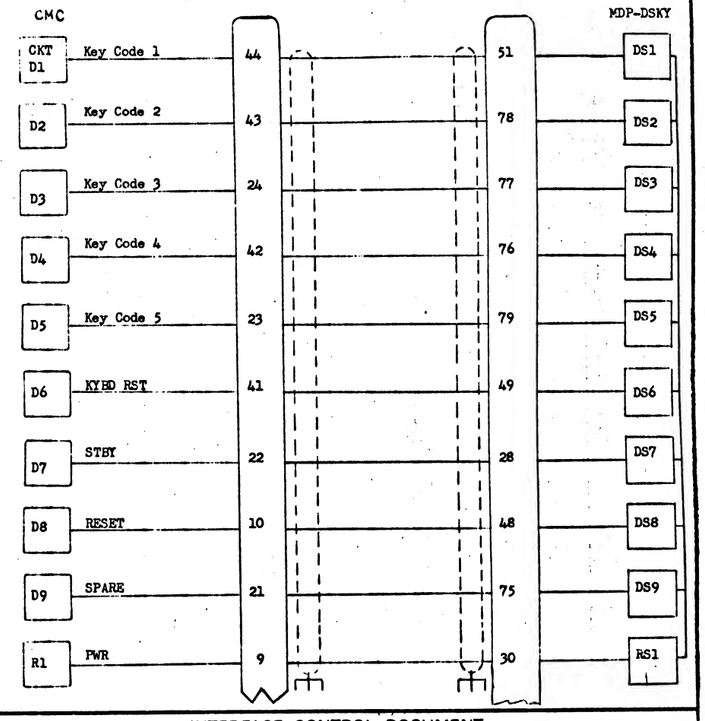
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 49

FORM MIIO-N-50 NEW 4-63

REVISIONS

11.1 Interface Wiring Data



INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

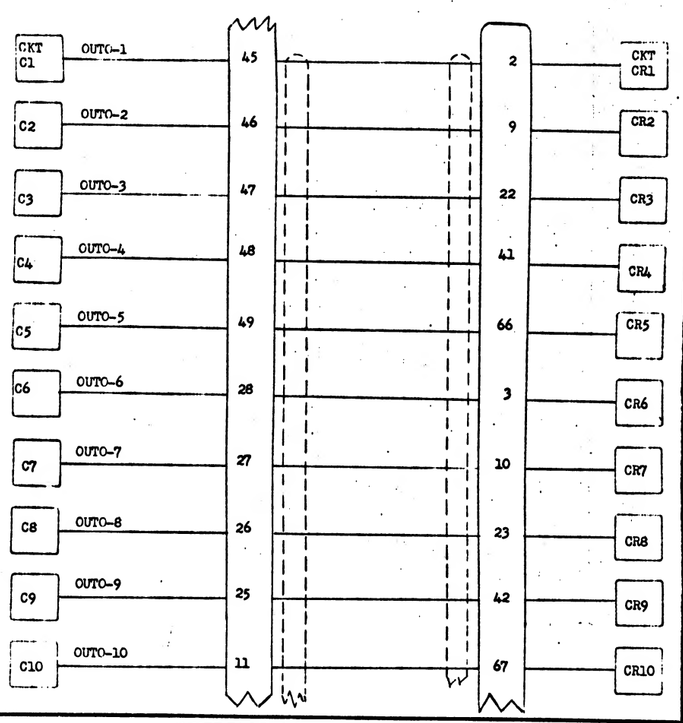
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 50

FORM MIIO-N-50 NEW 4-63

REVISIONS

11.1 (Cont)



INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

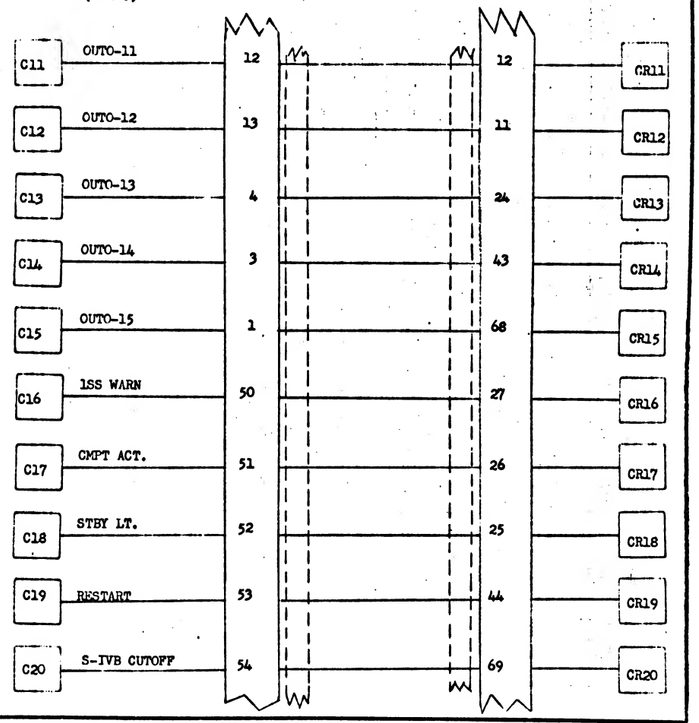
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 51

FORM MIIO-N-50 NEW 4-63

REVISIONS

11.1 (Cont.)



INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

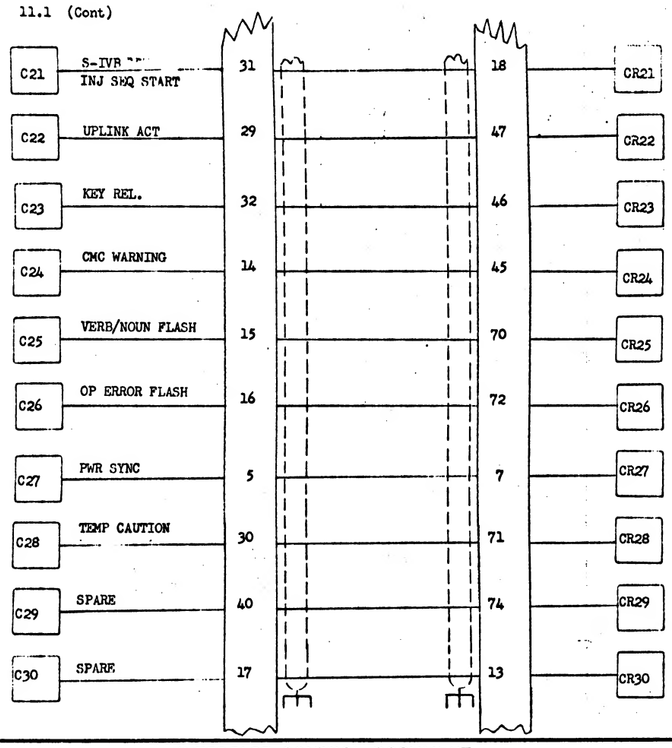
CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216

SHEET 52

FORM MIIO-N-50 NEW 4-63

REVISIONS

11.1 (Cont)



INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

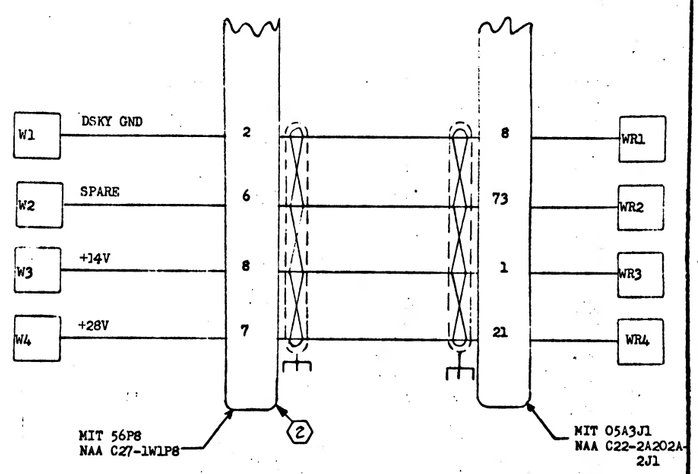
NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216
		SHEET 53

FORM MIIO-N-66 NEW 4-66

REVISIONS

11.1 Continued



INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216
		SHEET 54

FORM MIIO-N-66 NEW 4-66

REVISIONS

11.2 Circuit and Signal Characteristics

Waveform Specs

D Circuit

Volt. Amp.	0 - 28
Rise Time	< 1 μ sec.
Current Amp.	2 MA Maximum
Rise Time	< 1 μ sec.
Frequency	2 PPS maximum

C Circuit

Volt. Amp.	0 -28
Rise Time	< 1 μ sec.
Current Amp.	5 MA Maximum
Rise Time	< 1 μ sec.

W Circuit

W1	Ground
W2	Spare
W3 Current	100 ma or less
W4 Current	250 ma (pulsating)

INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216
		SHEET 55

FORM MIIO-N-66 NEW 4-66

REVISIONS

12.0 CMC MDC DSKY to Spacecraft Displays

This interface covers the signals from the CMC which illuminate the caution and warning lights in the "Caution and Warning" subsystem.

There shall be three signals:

1. CMC (Warning) - Indicates a malfunction in the CMC Power Supply or CMC Circuit
2. ISS (Warning) Inertial Subsystem - Indicates a malfunction in the IMU, PIPA Loop, CDU.
3. PGNS (Caution) Primary Navigation/Guidance System - Indicates Gimbal Lock, IMU Temp out of Tolerance, Radar Failure, Program Alarm, Restart (computer).

INTERFACE CONTROL DOCUMENT

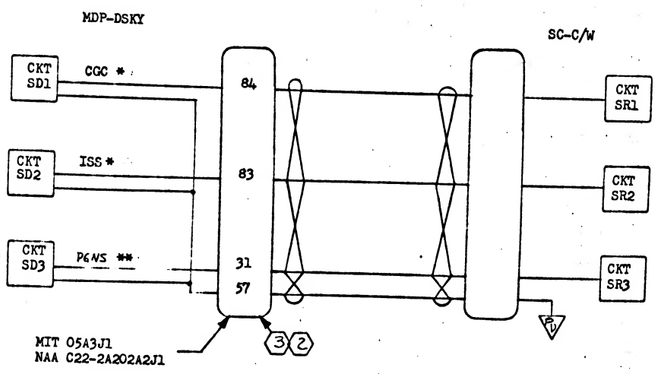
THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216
		SHEET 56

REVISIONS

12.1 Interface Wiring Data

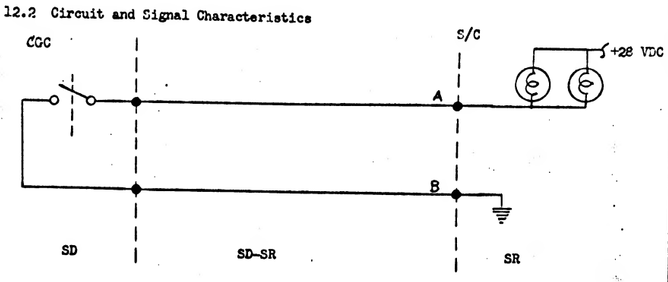


* Red Light

** Yellow Light

REVISIONS

12.2 Circuit and Signal Characteristics



All measurements made from A to B, B Ref.

Voltage: 28 VDC (nominal from S/C bus)

Current: 120 ma Steady State
1 amp peak for 10 milliseconds

Contact Rating: 0.5 amps (+28 VDC into lamp load)

Circuits

SD1 - SD3 as shown above

SR1 - SR3

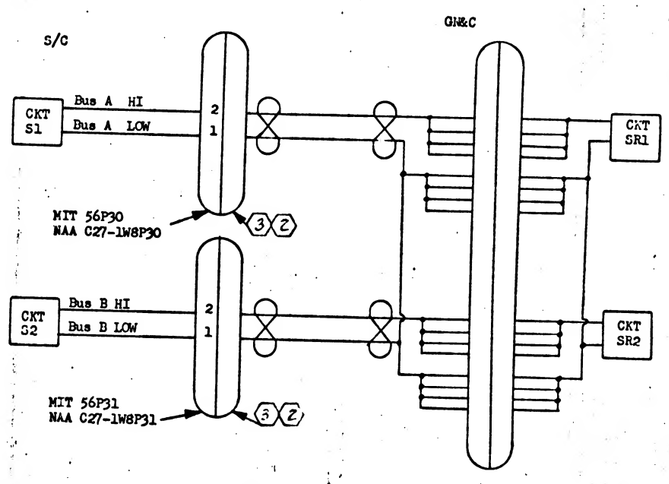
REVISIONS

13.0 Computer to Spacecraft Power

This interface covers the Power interface to the AGC and is included in this ICD for reference only. The Power Interface for the G/N and C shall be covered in ICD MH01-01327-216.

REVISIONS

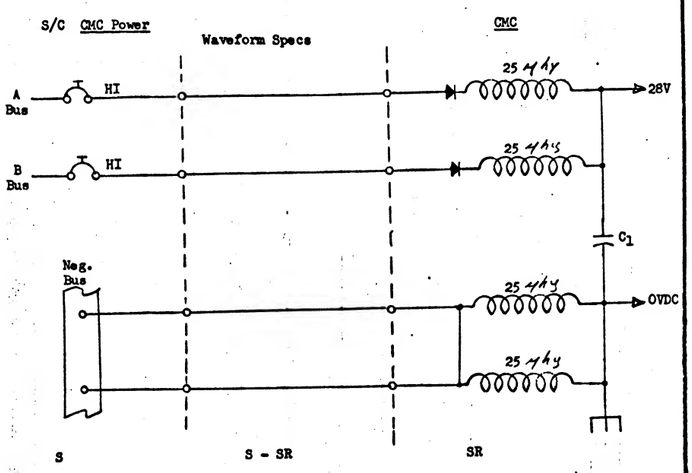
13.1 Interface Wiring Data



NOTE: For Reference Only

REVISIONS

13.2 Interface Circuit and Signal Characteristics



All Measurements at CMC Interface

Voltage: 25.8 to 30.8 at CMC Interface
Transients: Per MH01-01327-216
Current: 4 amps maximum

Circuits

S1, S2
SR1, SR2

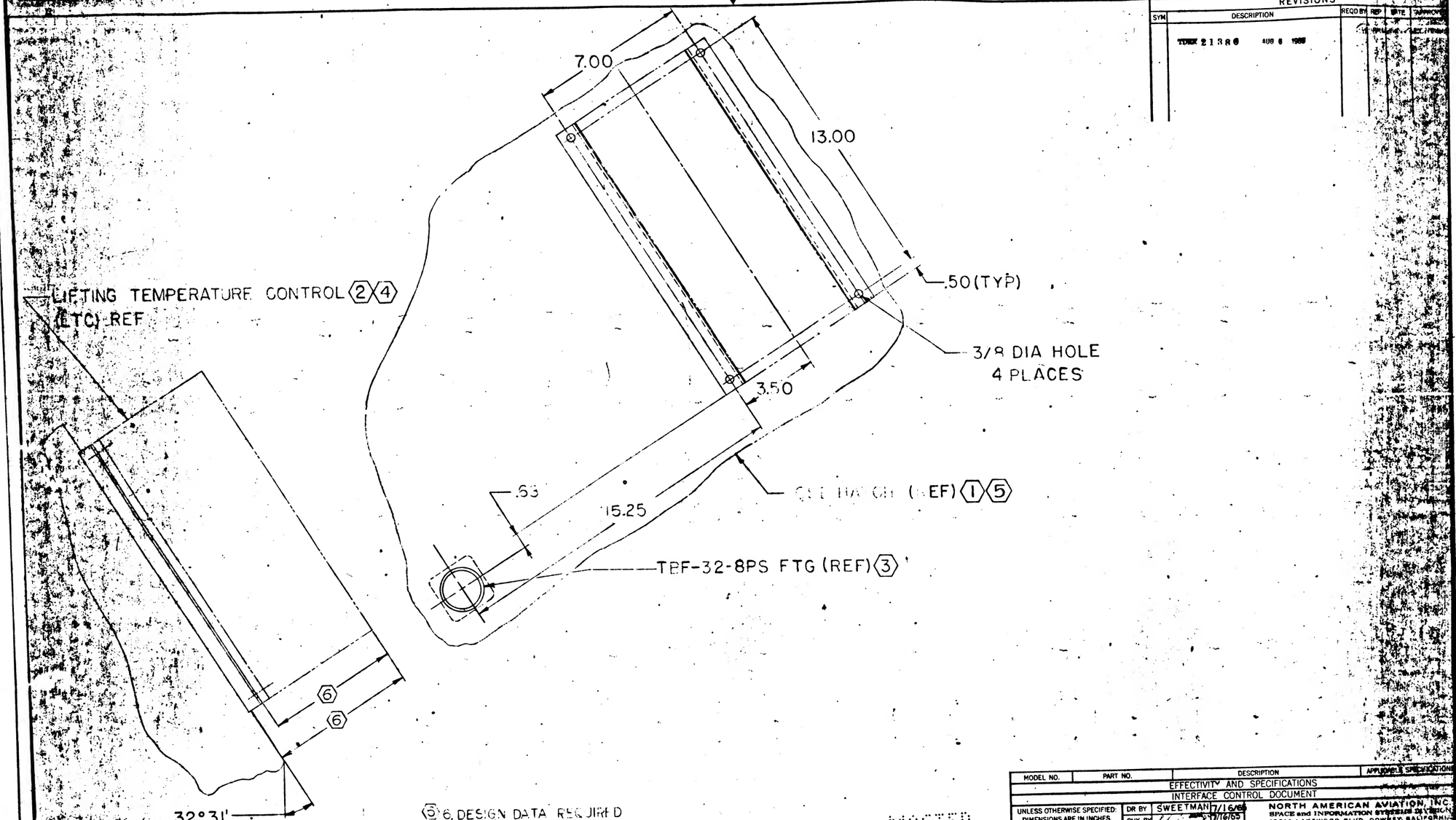
INTERFACE CONTROL DOCUMENT

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT NO.	SIZE	
03953	A	MH01-01380-216
		SHEET 61

REVISIONS					
SYM	DESCRIPTION	REQD BY	REP	DATE	APPROV
	TDEK 21386 AUG 8 1966				



5. 6. DESIGN DATA REQUIRED
5. 5. REFERENCE NAA DWG. G16-824425
4. 4. REFERENCE ICD MHOI-01382-100
3. 3. BENDIX SCINTILLA CORP., SIDNEY, NEW YORK.
2. 2. MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE, MASS.
1. 1. NORTH AMERICAN AVIATION COMPANY, SPACE & INFORMATION DIV., DOWNEY, CALIF

NOTES UNLESS OTHERWISE SPECIFIED

MASTER

MODEL NO.	PART NO.	DESCRIPTION	APPLICABLE SPECIFICATIONS
		EFFECTIVITY AND SPECIFICATIONS	
		INTERFACE CONTROL DOCUMENT	

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS .XX = ± .03, .XXX = ± .010; ANGLES ± 30'

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS AND NOTHING HEREIN CONTAINED SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN ALL PARTIES AFFECTED.

DO NOT SCALE

DR BY	SWEETMAN	7/16/65	
CHK BY		7/16/65	
AUTH SIGNATURE	REP	DATE	
	NAA		
	MIT		

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

INTERFACE - LTC TO GSE HATCH - MECH. MIT/NAA

CODE IDENT NO.	SIZE	
03953	D	MHOI-01382-100
SCALE		SHT

TDRR 27371

28 021

Restricted Rel.

AUTHORIZED SIGNATURES	REPRESENTING	DATE
M.R. White	NAA-S&ID	2/25/66
[illegible]	MIT Eng	29 Nov 65
W Stameris	MIT	17 Feb 66

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

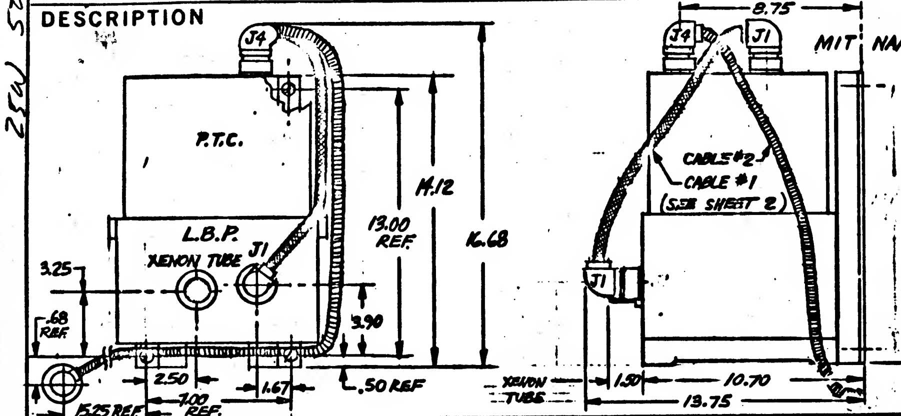
CODE IDENT. NO. 03953	IRN № 3651	
SYM.	DOCUMENT NUMBER	REV.
A	ICD NO. MH01-01381-100	N/C

TITLE: INTERFACE - LTC TO GSE HATCH - MECH MIT/NAA

RELEASE DATE 2-28-66

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ASSOCIATE CONTRACTOR

DESCRIPTION



COPIES TO:	DEPT.
T. Moorehouse	H805
R.A. Kennedy	H829
A.L. Zeitlin	H648
E.J. Bowen	F839
K. Derbyshire	JD60
J.P. Yeager (NAA)	AE99
13 Copies	
J.P. Yeager (MIT)	AE99
4 Vellums	
J.P. Yeager MIR	AE99
1 Vellum	
Microfilm Reg	
D.R. Hafner	HB 04

DR. BY LSG	DATE 11/26/65
DEPT/GROUP MIT/GSE	EXT.
SHEET 1 OF 2	

REASON: TO ADD REQ'D DESIGN DATA

OFFICIALLY RELEASED BB 1966 FEB 28 AM 9:23

FORM M 110-N-88 REV 9-65 (2) SYMBOLS: A = ATTACH IRN COPIES TO DRAWINGS

INTERFACE REVISION NOTICE

Note: Cable 1 = 2 Feet
Cable 2 = 4 1/2 Feet
These cables will mate their respective connectors providing there is no NAA obstruction in the paths indicated on sheet 1 of 2

CODE IDENT NO. 03953	IRN NO. 3651	
	ICD NO. MH01-01381-100	
	SHEET	2 OF 2

FORM 2940-H REV 9-65

AUTHORIZED SIGNATURES	REPRESENTING	DATE
[signature]	NAA-S&ID	11/5/65
[signature]	MIT	10 NOV 65

INTERFACE REVISION NOTICE

INTERFACE CONTROL DOCUMENT

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA

CODE IDENT. NO. 03953	IRN NO.: 00872
ICD NO.: MH01-01381-100	
TITLE: Interface - LTC to GSE Hatch - Mech MIT/NAA	

THIS DOCUMENT SPECIFIES TECHNICAL REQUIREMENTS BETWEEN ALL PARTIES AFFECTED HEREIN. NOTHING CONTAINED IN THIS DOCUMENT SHALL BE DEEMED TO ALTER THE TERMS OF ANY CONTRACT OR PURCHASE ORDER BETWEEN NAA AND THE ADDRESSEE

DESCRIPTION

On F/D

IS 5/16 x 24 Threaded Insert 4 places

WAS 3/8 Dia Hole 4 places

CDRR 24052 NOV 16 1965

REASON: To conform to correct interface of Hatch	DRN: Derbyshire

FORM 9410-10-00 NOV 4-63